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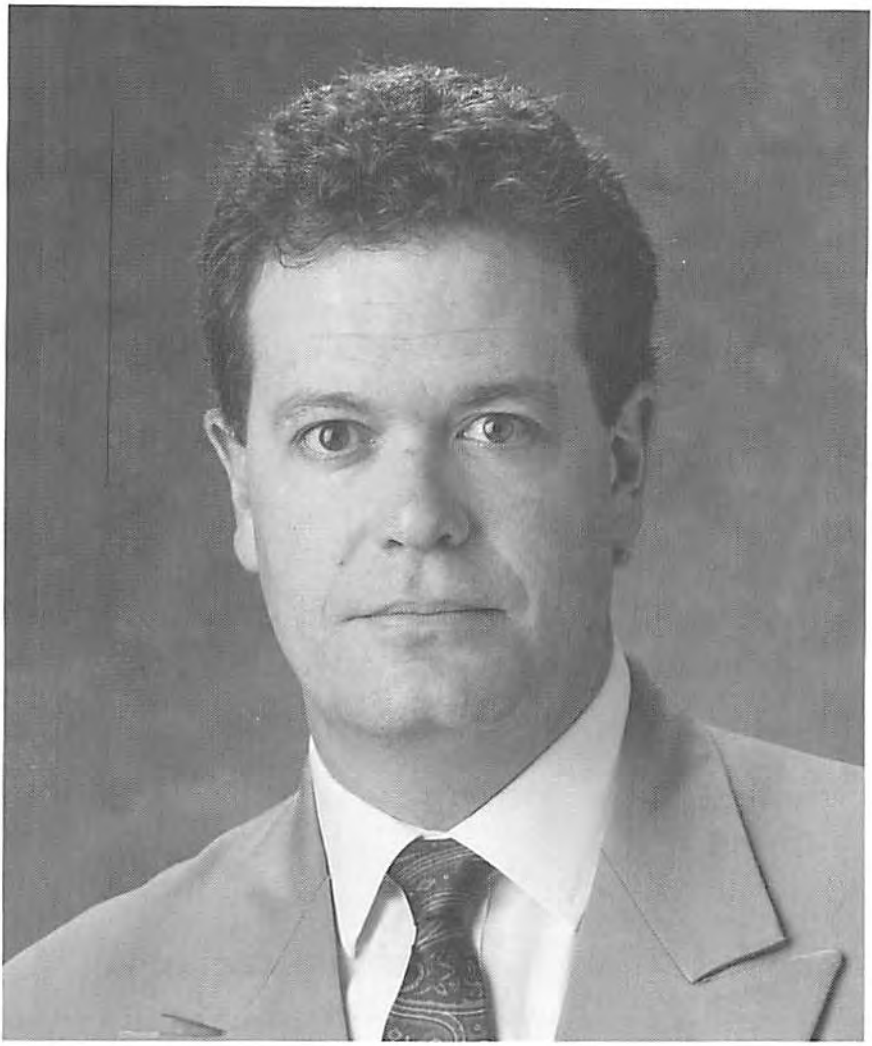

David L. Webb

PRESIDENT 1994-95

THE COAL MINER

TRUE—he plays no grandstand role in life
But his importance is vital, great and just:
For without his toil in earth's caverns deep,
Civilization would soon crumble into the dust.
AD 1964 From his poem – Vachel Davis

(Dedicated on State Capitol Lawn, Springfield, Illinois, October 16, 1964)

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PROCEEDINGS
OF THE
ILLINOIS MINING INSTITUTE

ANNUAL MEETING
103rd YEAR
Collinsville, Illinois
Thursday and Friday, September 28-29, 1995

The opening session of the 103rd Annual Meeting of the Illinois Mining Institute was convened at 10:00 A.M., Thursday, September 28, 1995, in the LaSalle Room of the Gateway Center. David L. Webb, President of the Institute, presided.

OPENING REMARKS

Dave Webb: Good morning. My name is Dave Webb and I am very honored to serve as this year's president of the Illinois Mining Institute. I would like to now call the 103rd annual meeting to order and to thank the many individuals who make this Institute a success.

For more than a century, coal companies, equipment manufacturers, suppliers, government agencies, educational institutions and miners have come together at our Institute to openly share new technology, advances in safety and productivity, and to share fellowship at our annual meeting.

The success of this organization can be measured by the hundreds of scholarships given through the years to mining students and the published proceedings of our annual meetings. The not so obvious is the sharing of technology and fellowship that has kept this organization alive and well for 103 years.

Before we start the first technical session, I have a few announcements. Our invited luncheon speaker today is Mr. Joe Spivey, President of the Illinois Coal Association, who will speak on the Illinois Coal Association: Past, Present and Future; however, due to health reasons, Taylor Pensoneau, Vice President of the Illinois Coal Association, will actually deliver the speech.

There will be a fellowship from 5:00 to 7:00 p.m. in the exhibit hall. Please come and enjoy food and beverage and visit with our full convention hall of exhibitors.

I would like to ask for everyone's help in keeping our necrology list current. If you know of any of our members who have passed away, please inform the staff at the registration desk.

Please buy your raffle tickets for the two airline tickets donated by Zeigler Coal and the golf clubs donated by Jim Justice of DuQuoin Iron and

Supply. The winning tickets will be drawn at the end of the meeting on Friday. We appreciate these donations; they greatly support financing our institute.

There will be guards posted at all entrances to the exhibit hall, so please help out by displaying your registration badge proudly to show your support for the cause.

The business meeting will be held at 9:00 a.m. tomorrow morning in the LaSalle Room. I urge everyone to attend. We will elect officers and board members, review finances and hear reports from our colleges receiving scholarships. If you have any suggestions for next year's meeting, please come to the business meeting and share them with us.

Following the business meeting at 11:00 a.m., we will convene the second technical session. Mr. Robert Kudlawiec, Maintenance Manager, Cyprus AMAX Wabash Mine, will chair this session on Process Innovation in Coal Cleaning and Use.

The theme of this morning's technical session is Recent Advances in Mining Technology in the Illinois Basin. At this time, I would like to introduce you to the chairman of this session, Mr. Mike Caldwell, Vice President of Engineering and Operations Planning, Freeman United Coal Mining Company. Mike.

TECHNICAL SESSION I: RECENT ADVANCES IN MINING TECHNOLOGY IN THE ILLINOIS BASIN

Thursday, September 28, 1995
LaSalle Room, Gateway Center

Mike Caldwell: I would like to welcome you all to this morning's technical session. Our theme for the presentations this morning is recent advances in mining technology in the Illinois Basin, and I think we have a fine set of speakers ready to discuss several aspects of that topic. The first speaker is Mr. Tom Hutchinson, Account Executive, Mine Technik America, Inc., who will present a paper on CST Gearboxes for Longwalling. Tom.

Tom Hutchinson: Thank you, Mike. I am very happy to be here in Illinois this morning.

Mike Caldwell opens the Thursday morning technical session.

CST GEARBOXES FOR LONGWALLING

TOM HUTCHINSON, P.E.

Mine Technik America, Inc.
Washington, PA

INTRODUCTION

Over the last twenty years we have seen an enormous evolution in all facets of longwall mining. The face conveying systems are included in this developmental phenomenon.

From systems conveying a "whopping" 700 tons per hour, equipped with twin 22 mm chain and 375 connected horsepower, through today's super faces producing 4,000 tons per hour and using twin 42 mm chain driven by over 2,500 HP; we have seen a seemingly never-ending increase in output, speed and power in armored face conveyors.

We've seen AFC drive systems powered through small fluid couplings (providing minimal soft start capability) evolve to larger fluid drives, on to two-speed, direct-connected electric motors and then on to even larger fluid drives with double delay chambers.

In recent years there have been the beginnings and general acceptance of true soft start systems in the form of controlled fill water couplings and Controlled Start Transmissions, or CSTs in use on longwall faces.

I am here to describe our experiences with CST drives in longwall mining.

WHAT IS A CST?

"CST" stands for controlled start transmission. The Dodge Reliance Company has applied this technology involving special gearboxes equipped with special controls to belt conveyor drives for many years.

In short, the CST utilizes a "differential" arrangement where the motor starts up under a virtual no-load situation with the motive power being spent turning a free-wheeling ring gear on the output portion of the gearbox. Then, by using a controlled brake application, the ring gear is gradually locked up, thus, transferring the motor torque to the output shaft to drive the conveyor. This is a fairly straight forward machine which most farmers, drillers or machine operators are familiar with.

The advanced technology comes into play when multiple drive units are used to power a single machine. Dodge Reliance has developed a system for multiple booster drives to power a single strand of belt conveyor while synchronizing their pulling effort.

Several years ago, Westfalia Becorit (WB), a leading longwall equipment producer and a predecessor to MTA, developed, in conjunction with Dodge Reliance, the WB/CST gearbox for use on a longwall face conveyor. This development involved the design of a totally new gearbox (size 45) for use with the project. Keep in mind that at the time that size gearbox was larger than needed on any existing equipment.

The gearbox was made to join up with the final stage planetary made by Dodge Reliance. WB also designed the control system for this CST drive called "Protec".

WHY DO WE NEED CST DRIVES?

Basically, the development of CST drives has been driven by a two-fold force. First, necessity has forced the development of some way to apply the enormous horsepower required to start and run the super-high capacity conveyors while still being able to protect the AFC chain from being physically torn apart in the event of a blockage or worn out prematurely by unnecessarily high tensions. While larger chains are theoretically possible to keep pace with the larger horsepowers required, there is a practical limit to chain sizes, particularly in low- to mid-range seams.

So the proper use of a CST can permit the use of less expensive, lower torque electric motors and the resultant relief for the mine's power system. Also, effective limiting of the starting torque, load sharing and instantaneous power interruption can protect AFC chains from over stress.

The second reason a CST system is desireable is the resultant longer life of components such as sprockets, chains, flights and panline.

WHAT ARE THE PRACTICAL BENEFITS OF CST?

The motor can be a less expensive, lower torque motor. It starts under no-load and can remain running indefinitely as the other motors are sequenced in. This affords a starting sequence which is kind to the mine's power system, offering better power factors and smaller inrush currents (fig. 1).

The rampup time of the chain speed is adjustable and results in less need for high chain forces resulting from acceleration (fig. 1).

True load sharing between all motors is a reality with CST. Therefore, when the AFC has 3 X 800 hp motors, all the power is available for the system as required (fig. 2).

True instantaneous load interruption is available to help prevent chain breakage due to blockages. Momentary shut down–stopping the AFC chain without the need to stop and restart the motors–is an option. Virtually unlimited starts per hour are possible since heating of the motors is not an issue. The CST cooling system is designed for multiple starts per hour.

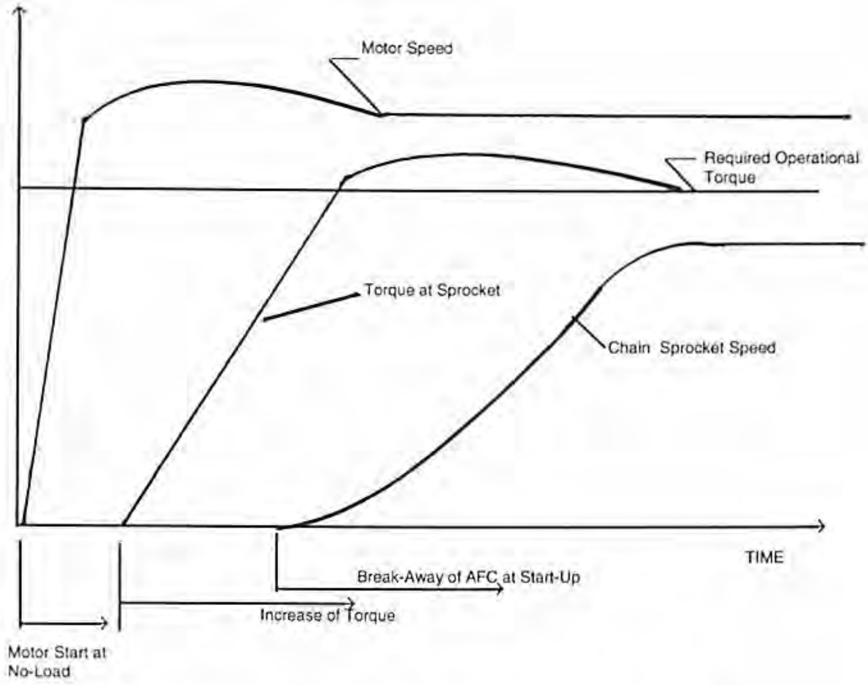

Figure 1. Soft start characteristics of WB/CST–planetary gearbox.

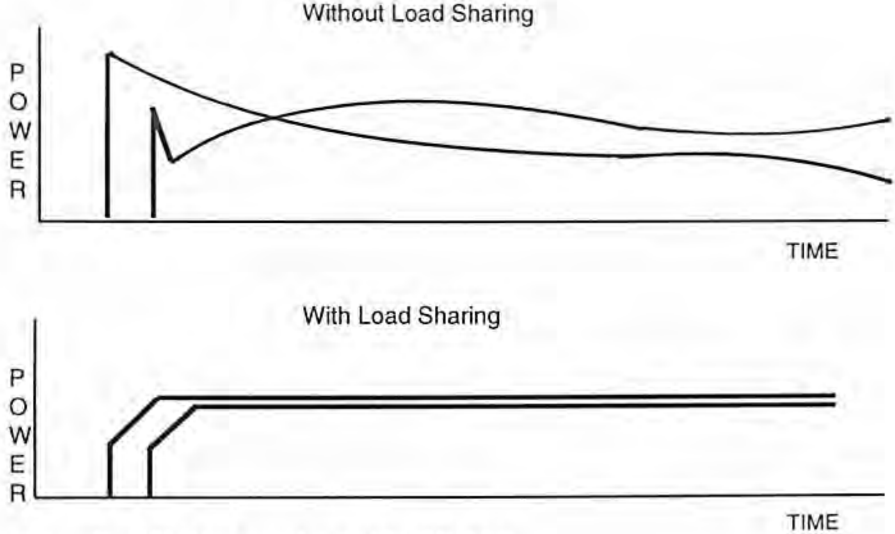

Figure 2. WB/CST gearbox with PROTEC.

HOW DOES THE SYSTEM WORK?

All three motors start up under no load as the ring gear of the CST free wheels. Pressure is applied to the clutch plates to gradually slow down the ring gear which speeds up the output shaft. Figure 3 shows this inverse relationship.

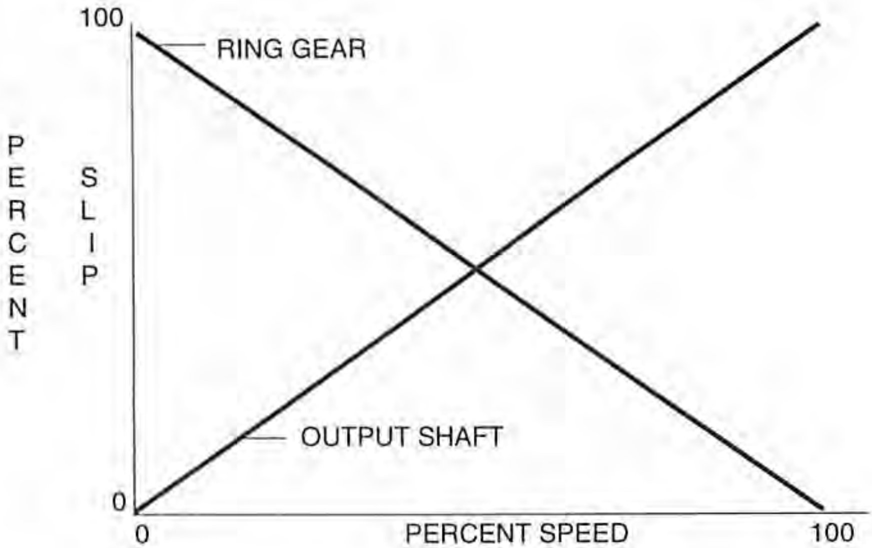

Figure 3. Rear gear versus output shaft of WB/CST gearbox.

At normal running speed, there is always 0.2 percent slip in the clutches which assures lubrication and prevents their locking up and assures instantaneous reaction time for load sharing or interrupt.

During startup when the pressure is applied to the clutches, there is a tremendous amount of heat generated at the clutches. This heat is removed from the immediate locale of the clutches and dissipated throughout the heat sink afforded by the gearbox mass by continually pumping 450 gallons per minute through the clutch area. Cooling water removes the average heat generated from the gearbox heat sink.

After the system is running, the amps of the motors are monitored. One motor is the lead motor, and the others are designed to match its performance by slipping the clutches of the respective motor to attain matching amps within a few percentage points.

WB has used the Protec system to provide instantaneous interrupt for protecting plow chains. This feature has been incorporated into the CST controls for protecting the AFC chain from breakage in the event of a sudden blockage.

WHAT BACKUP FEATURES DOES THE SYSTEM HAVE?

The base level operation is the lowest level of operation and would be needed in the event of a total system failure. It is comprised of a mechanical lockup of the clutches.

There is a manual bypass mode where the clutch pressure is applied according to a predetermined rampup effected by pressure oil passing through an orifice. This mode closely approximates the startup given by a typical fluid coupling.

The three levels of electronic control include: local board, which provides a preprogrammed hard-wired soft start; local Protec control, which provides possible introduction of parameters at each drive and individual power interrupt; and network, which is the highest level of operation.

OUR EXPERIENCE TO DATE

There are many mine faces which have the 45 series gearboxes in use with conventional motors and fluid couplings. Most have pending retrofit orders for providing the CST later.

There is one face operating with the CST, and, after about four months, the experience has been good. Some work remains on the system programming, and refinements are planned on the hardware in that the various components are to be consolidated. Nevertheless, the experience has been good, and the system has proven to be dependable and robust enough to qualify for use on a longwall face.

CONCLUSION

The development of the WB/CST system has been another in the continuing improvements in technology we've seen over the years. As before, the demand has prompted this development. Now we will see the production and operating efficiency increase to the maximum this system will permit, and further improvements will be introduced.

Mike Caldwell: Thank you, Tom, for that fine presentation. Are there any questions?

Our next speaker is Danny Stickel, Director of the Mining Technology and Development Group at Arch Mineral Corporation, Fairmont, West Virginia. Danny has a bachelor of science degree in engineering of mines from West Virginia University. He began his mining career in 1976 as an engineering technician with the U. S. Bureau of Mines in Spokane, Washington. Danny was then accepted into U. S. Steel's Mining Coop program in

1977, while attending West Virginia University. After graduating from West Virginia University in 1980, he joined U.S. Steel Mining Company as a full time employee, serving in various engineering and operations capacities, including longwall coordinator over two longwalls at the Pinnacle Creek No. 50 mine. Danny joined Arch Mineral at the Arch of Kentucky division as senior underground planning engineer in 1986. In 1988, he moved back into operations as longwall and mine superintendent of Arch of Kentucky's No. 37 mine. He served as mine manager at Arch's Cumberland River Coal Ovenfork mine and No. 37 mine longwall complexes prior to being promoted to his present position. Danny is going to tell us all about the Archveyor™ Automated Mining System.

Danny Stickel: Thank you. It is a pleasure to be here this morning.

THE ARCHVEYOR™ AUTOMATED MINING SYSTEM

DAN STICKEL
Arch Mineral Corporation
Fairmont, West Virginia

INTRODUCTION

Arch Mineral Corporation is a United States coal producer headquartered in St. Louis, Missouri with mines operating in the states of Illinois, Kentucky, Virginia, West Virginia and Wyoming. In 1994, our mines produced 13.2 million surface tons, 13.2 million underground tons and one million highwall tons for a total of 27.4 million tons.

Of the 1994 highwall production, 624,000 tons were mined by our Archveyor™ Automated Mining System. So far this year (through August) Archveyor™ production stands at over 656,000 tons.

The Archveyor™ Automated Mining System is operating in the Hanna Basin in southern Wyoming at our Arch of Wyoming Medicine Bow Mine (fig. 1). The Archveyor™ Automated Mining System was designed by Arch Technology, a small group of mechanical and electrical technicians and engineers assembled by Arch in late 1990.

Arch management approved funds to design and build the first Archveyor™ in July 1990; it was installed in June 1992.

Figure 1. The Archveyor™ Automated Mining System.

STARTUP AND PERFORMANCE

Startup of the Archveyor™ system was not without problems. However, we have been extremely pleased with how reliably the automation, controls and electronics performed. Arch's top management had more concerns about the automation than the mechanical components. As it turned out the automation and controls have been the most reliable part of the system.

Within three months of startup the machine had exceeded monthly production of 50,000 tons. But due to chain problems on the chain conveyor, we were unable to maintain a consistent increase in production. The chain problems were diagnosed as a metallurgy problem, combined with a control problem that enabled the chain conveyor to run into the rear of the continuous miner.

Once the chain problems were corrected, productivity continued to improve. In June 1994, the system length was increased from 520 feet to 720 feet and the 14CM class miner was upgraded to a 12CM class machine. This upgrade, in addition to continued design improvements, has enabled the system to achieve recent monthly production of 135,000 tons.

Safety Features

Improved safety is inherent in the design of the Archveyor™ Automated Mining System. The high degree of automation reduces the number of miners exposed to normal pit conditions. The system operates on a three shift, five days per week schedule with only one operator, one mechanic and three truck drivers each shift.

Additionally, operating the Archveyor™ system does not require anyone to be located in front of the entry or near the highwall. Should a methane or coal dust ignition occur, no one would be exposed to the hazard. Even during routine maintenance no one is required to be located in front of the hole.

The Archveyor™ system is equipped with a ventilation system that minimizes the hazards of methane and coal dust ignitions. The continuous miner is also equipped with a methane monitor that warns the operator when methane levels reach one percent and de-energizes the miner if the methane level reaches two percent.

The entire Archveyor™ system is designed with safety in mind. All the equipment operated underground is built to XP standards. The control scheme is designed and programmed with the number one goal being to recover the machine without sending anyone in the hole. Redundant communication systems and computer programming along with the ability of the chain conveyor to pull a disabled continuous miner has resulted in us having to go into a hole only once since the machine went into service in 1992. In hind sight, even this one instance could have been avoided.

Productivity

The Arch of Wyoming highwall Archveyor™ system has consistently been Arch Mineral's most productive and lowest cost operation. Daily production rates currently average around 6,000 tons per day. Productivity has approached 250 tons per employee-shift. Justification for the original funds to build the system were based on cost of production of $10.00 per ton. The machine has consistently been beating this projection with a direct mining cost significantly less than $5.00 per ton.

Machine Configuration

The Archveyor™ system is operated on a 24-hour schedule with routine maintenance being done between holes on whatever shift it may fall. Generally the machine produces coal Monday through Friday and major maintenance projects are scheduled for weekends.

The current Archveyor™ Automated Mining System uses a modified continuous miner followed by a continuous haulage chain conveyor followed by a loadout vehicle for loading 100 to 150 ton trucks.

The continuous miner is a modified Joy 12CM7 equipped with a twelve foot wide 44 inch diameter hard head, CLA's, 38 inch wide conveyor and 13 foot long tail section. Significant hydraulic and electrical modifications were made to the original Joy core to enable it to be completely automated.

The continuous miner is connected to the Archveyor™ chain conveyor by a distance measuring device, hydraulic lines, power and control cables and safety chains for dragging the miner in emergency situations. On board the miner are roof and floor gamma detectors, inclinometers and a ring lazer gyro. These instruments are the key to the automation of the machine. They provide critical information to the Allen Bradley controls and the machine operator to keep the machine within the seam and on the correct azimuth.

The Archveyor™ chain conveyor utilizes the same chain for both tramming the machine and conveying the coal. The conveyor is raised up off of the ground by hydraulic lift cylinders. The sides of the conveyor can be programmed to raise simultaneously or independently depending on condition, such as seam pitch. For tramming, the hydraulic cylinders are retracted, dropping the conveyor to the ground. This places the entire length of the return side of the chain conveyor in contact with the floor for moving the machine either forward or reverse.

The conveyor is equipped with two speed drives, slow for tramming at 56 feet per minute (fpm) and fast for conveying at 173 fpm.

Ventilation to the face is maintained by using an auxiliary fan located at the outby end of the conveyor. The fan blows air through a flexible ventilation tube housed within covers on the conveyor.

The conveyor is equipped with 28-40 hp, 1,000 volt drive motors evenly distributed along the machine. This enables the chain conveyor to maneuver in steeply pitching seam conditions. At Arch of Wyoming, the seams often dip at 18 percent or 10 degrees. The conveyor has had very little difficulty with these grades even when pulling a disabled continuous miner out of the hole.

The loadout vehicle transfers the coal from the Archveyor™ to the 100 and 150 ton haul trucks. It serves as the main control center for the Archveyor™ system. It houses the computer controls, the main power center, the hydraulic pump station, the power cable reel and the operating technician station. Arch of Wyoming uses a 7,200 volt primary power feed to the Archveyor™ system. The Archveyor™ system voltage is 1,000 volt.

OPERATING THE ARCHVEYOR™

Each piece of equipment in the Archveyor™ mining system is linked by the computer controls. To start the mining process, the Archveyor™ mining system is placed in manual; a ground man starts the continuous miner using conventional remote control. Once the ground man has the machine positioned on the correct heading, he turns the controls over to the operating technician. The operating technician then initiates the computer controls to fully computer automate the mining system. The computer is programmed to cut, load and convey the coal automatically. The Archveyor™ mining system is designed to be a truly automated continuous mining system as opposed to a remote control cyclical mining system.

The miner is programmed to advance a set distance before the conveyor moves up behind it. The continuous miner automatically sumps, shears down, sumps, and shears up in a continuous cycle. The miner's boom position and distance from the conveyor is monitored by computer so that coal is transferred without spillage.

Machine navigation and coal quality are maintained by the gamma detectors, inclinometers and a gyroscope on board the miner. Although they are seldom used, the machine is also equipped with video cameras. Data from the gamma detectors, inclinometers and gyroscope is fed to the computer where it is analyzed. The computer then automatically signals the continuous miner if any adjustments are needed to keep the machine in seam and on azimuth. If for some reason there is an extreme adjustment required, for example due to a geologic anomaly, the operator can at any time override the automated controls.

The continuous miner repeats the shear and sump cycle until the tip of the miner discharge boom is at the front edge of the conveyor hopper. At this point the computer commands the conveyor to be advanced to the miner. During the conveyor advance sequence the miner is programmed to be in the shear up cycle. This utilizes the area below the drum and in front of the miner pan as bunker space so it can continue to cut coal while the miner conveyor is off during the advance. This assures maximum utilization and efficiency of the continuous miner. The conveyor advance cycle takes approximately 30 seconds. When the computer commands the chain conveyor to advance, the miner conveyor is automatically turned off to clear enough top chain at the chain conveyor hopper end to prevent spillage behind the miner. The computer then commands the chain conveyor to lower to the ground, advance to the miner and raise to enable material to be conveyed again. When the return side chain is off the ground, the chain conveyor and miner conveyor are both started and the mining cycle resumes.

System Controls

The operator station provides the operating technician critical feed back on the status of the Archveyor™ mining system. Allen Bradley controls are used to sequence the miner, conveyor and loadout vehicle. Information generated by the ring laser gyro, gamma detectors and inclinometers is monitored by the operating technician to maintain horizon and azimuth control. Self diagnostics have been integrated into the controls to improve speed of trouble shooting and system protection. Hydraulic system pressure and temperature as well as the electrical control box temperatures are monitored to assure machine safety. Motor currents are monitored for all conveyor drive motors and the cutter head motors on the miner. System current is monitored on the loadout vehicle power center. Critical mining sequence functions such as miner heading, pitch, sump distance, shear up, shear down and system move ups are displayed for the operating technician.

Data Acquisition System

A data acquisition system, located in the control cab, provides a history of key operating parameters for the Archveyor™ mining system. The data acquisition system is in essence an automated real time generated time study for the entire system. The data is periodically downloaded so that hard copy reports can be generated.

Every step that the system takes is controlled by the computer. Therefore, every move can be timed and recorded. For example, the data acquisition records the number of shear downs and shear ups and the average time and maximum time it takes for those cycles. Those times, plus the recording of the sump distances for both top and bottom sumps can give the operator an instantaneous view of the current machine performance to compare it to established standards.

If something is wrong in some part of the mining cycle, the data acquisition system gives us up-to-date information to flag the problem. We can quickly start narrowing down a problem area as soon as we see the machine performance beginning to deviate from established and accepted norms. The data acquisition system is one of the tools available to our operators to keep the machine at peak performance.

FUTURE APPLICATIONS

Low operating cost, high productivity and an outstanding safety record have stimulated an interest in advancing the Archveyor™ mining system underground. From the beginning, it was anticipated that the system's technology could eventually be applied underground. In December 1994, the Arch Board approved funds to design and build our first underground version of the machine. Pending underground machine approval, we expect the machine to be ready for installation next year.

To successfully take this automated mining system underground, we need to combine several proven technologies. For the most part, the individual pieces of this technology are not new.

Application of the Archveyor™ underground will require some modifications to the conveyor and the addition of two major pieces of equipment to the existing system. The modifications to the conveyor will include shortening the pan sections to provide a tighter turning radius and the addition of a slurry dusting system.

The first major additional piece of equipment is a bolter car between the continuous miner and the Archveyor™. The bolter car will be used during the development of the four-entry gate. The bolter car will have roof bolters on both sides and will bolt the roof immediately behind the miner. This will enable the system to make up to 200 foot runs before place changing the system.

Once panel development is completed, the bolter car will be removed from the system, and the panel will be winged or retreat mined. This retreat mining will consist of wing cuts approximately 480 feet deep, with no roof bolting, much like the current highwall application where the belt entry is analogous with the pit highwall.

The second major addition to the underground system is a rigid belt structure. The Archveyor™ will travel alongside this structure similar to typical continuous haulage design used throughout the industry to load coal onto the mine belt.

CONCLUSION

In conclusion, we have been extremely pleased with the performance of our Archveyor™ Automated Mining System. Our Arch of Wyoming division exists today only because the Archveyor™ has enabled them to lower their operating costs and improve their productivity in a very competitive mining region.

The Archveyor™ system has proven to be a very adaptable and flexible mining system in the steep pitching seams of the Hanna Basin. We feel that it has the potential to revolutionize the underground mining industry. The Archveyor™ technology has provided us an opportunity to utilize automation to improve safety, lower operating costs and raise productivity.

Mike Caldwell: Thank you, Danny.

Our third speaker this morning is Mr. Peter Seear, Marketing Manager for Highwall Miner and FCT, Joy Technologies, Inc., Mining Machinery Division, Franklin, Pennsylvania.

Mr. Seear has a bachelor of science degree in production engineering from Coventry University in the United Kingdom. He did undergraduate studes with Chrysler Corporation in the U.K. and later as a graduate engineer with Anglo American in Rhodesia and South Africa. He worked in London for four years designing deep hole drilling equipment and then emigrated to South Africa to work for Anglo American as General Manager of their main manufacturing plant in Johannesburg. The Johannesburg plant made Long Airdox bridge haulage systems and roof bolters, plus screens, feeders, conveyors and down hole drills.

Mr. Seear joined Joy Technologies in Johanneburg in 1983 as Manager of Research and Development; he was later promoted to Technical Director. In 1991, Mr. Seear transferred to the Joy facilities in Franklin, Pennsylvania, where he is responsible for managing Joy's FCT and highwall product lines.

The title of Mr. Seear's speech is " The Highwall Miner–Concept and Practical Experience." Mr. Seear.

Peter Seear: Thank you, Mike. I am very happy to be here today.

[Mr. Seear's paper was not available for publication]

Mike Caldwell: Thanks, Peter.

Our final presentation this morning is by Mr. Richard M. Coleman, President of Coleman Consulting Group, Ross, California. The Coleman Consulting Group is a team of experts with backgrounds in shift work, operations research and management of shift work operations. With offices in Ross, California and Brisbane, Australia, Coleman Consulting Group designs and implements Best Cost Schedules for hundreds of clients in a wide range of industries. A psychologist, Mr. Coleman is a former Assistant Professor at Stanford University Medical School. He has advised the United States Olympic Team on improved alertness and performance, been a frequent guest on a number of television talk shows. His many articles on shift work have appeared in *Business Week*, *HR Focus*, *COAL*, *Industry Week*, *The Wall Street Journal* and a variety of other publications. His second book, *The 24-Hour Business: Maximizing Productivity Through Round-the-Clock Operations*, was published by the American Management Association in June, 1995. The title of his presentation this morning is "Worldwide Best Practices for Coal Mining Schedules."

Richard Coleman: Good morning, ladies and gentlemen.

BEST PRACTICES FOR COAL MINING SCHEDULES[1]

RICHARD M. COLEMAN

Coleman Consulting Group, Inc.
Ross, California

INTRODUCTION

If you have the right equipment and employees at the right place, at the right time and at the right cost, you have the perfect business schedule and need listen no further. If you're like most mine operators, however, you probably can improve your schedule with changes that will reach all the way to the bottom line. Unlike adding employees, materials or capital equipment, better scheduling is a cost-free way to improve profitability. A good schedule can save millions; a bad schedule will cost money every year.

Most mining schedules are either copied from another operation, based on tradition or the result of a contract negotiated far from the mine site. Unfortunately, most mine managers do not give much thought to schedules until a crisis develops, at which point the tendency is to implement the first solution that comes along; costly mistakes are easily made.

CASE EXAMPLE

An underground coal mine in New South Wales, Australia, implemented a new schedule when the union agreed to a contract change that deferred overtime until after the ninth hour. A new schedule based on employee suggestion was implemented quickly, and the cost per ton increased immediately by more than 15 percent. The new schedule neither adequately matched the workload nor did it adequately provide maintenance opportunities.

Schedules that successfully engineer business, employees and health and safety requirements are called "best cost schedules." A best cost schedule is not a day-off pattern or a shift length; it is the most cost-effective method to deploy equipment and personnel with employee buy-in and specific pay, work and coverage policies

MAXIMIZING LABOR AND CAPITAL

In coal mining operations, the key to scheduling is maximizing labor and capital while building in appropriate maintenance and support. In

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[1] The full paper was unavailable.

practice, however, traditional mining schedules may attain only 12 to 15 productive man hours per 24 hour day, and it is not unusual for more than 33 percent of the labor budget to be paid for non-productive time. Seeking improved performance, after a week of inefficient scheduling, employees are scheduled to work weekends at premium pay to catch up. Capital utilization is frequently below 50 percent, when looking at all 8,760 hours available each year.

Though the current schedule often is not the right one for its location, management and employees usually become experts at making it work. Management may be lulled into thinking there is no problem, but the expenses from lower production, high overtime, low morale and poor maintenance scheduling can be enormous. For example, at a medium-size underground coal mine in the midwestern United States, the identified savings from better scheduling was close to $7 million per year, after a one-time deferment of $20 million.

THE FUTURE OF SHIFT SCHEDULES

Looking ahead, it is very unlikely that today's schedules will be in use ten years hence. With more competitive pricing and shorter contract terms, the pressure to reduce cost per ton will grow. Best cost shift schedules offer the possibility of improving shift work for everyone involved–managers, shift workers, and their families, and the shareholders.

Mike Caldwell: Thank you, Richard. I wish to thank all of our speakers for their fine presentations this morning.

I would like to invite you all to come back to this room in about 30 minutes for our annual luncheon meeting. If you haven't gotten a ticket yet, you can get one at the registration desk in the lobby.

LUNCHEON MEETING

Thursday, September 28, 1995
La Salle Room, 12:30 P.M.

Dave Webb: Welcome to the 1995 Annual Luncheon. My name is Dave Webb and I'm the President of the Institute this year. I'd like to begin by introducing the head table this morning. On my left: Robert Kudlawiec, Cyprus AMAX, Wabash Mine, chairman of the Friday morning technical session; Tom Hutchinson, Mine Technik America, a speaker from this morning's technical session; Mike Caldwell, Freeman United, chairman of this morning's technical session; William Mullins and his wife, Mary; Richard Coleman of Coleman Consulting Group, Ross, California, another of this morning's speakers; and Joe Spivey, President of the Illinois Coal Association, who was supposed to be our luncheon speaker today, but due to a recent surgery, Taylor Pensoneau will deliver his speech for him. On my right: Bert Hall, who is the incoming IMI President; Mr. Steven Bishoff, Freeman United; Fred Bowman, Director of the Illinois Office of Mines and Minerals; Danny Stickel of Arch Mineral Corporation, one of this morning's speakers; Peter Seear, Joy Technologies, also a speaker from this morning's technical session; Taylor Pensoneau, Vice President of Illinois Coal Association; Don Goddard, President of Midcontinental Fuels; and John Lanzerotte, Mine Superintendent, Monterey No. 1 Mine, chairman of the IMI Scholarship Committee.

We also have some distinguished guests in our audience today. Any past presidents? Please stand up [Applause]. How about any honorary members? Please stand up [Applause]. Heinz Damberger and Phyllis Godwin, please stand. These people do a tremendous amount of work for the Illinois Mining Institute, and I don't know how we would really do it very well without them. Other helpers I want to recognize are the people that help out at the registration desk and the people from the Illinois State Geological Survey. I think they all deserve a big hand [Applause].

We have had some members pass away since our last meeting. They are John Brannon, Russell Dawe, R. R. Schubert, and William S. Smith. Please stand and join me to give a moment of silence for these members who have passed away. Thank you.

At this time I would like to introduce John Lanzerotte, chairman of the Scholarship Committee, who will introduce you to representatives from the universities and colleges and our scholarship recipients. John.

John Lanzerotte: A very important function of the IMI is the scholarship program. For the 1995-96 school year, the IMI is contributing ten thousand dollars to students through four regional colleges and universities. The IMI scholarship fund helps these colleges and universities attract and retain the best students. It also helps replenish mining professionals, thus ultimately helping the industry. And, our scholarship fund helps offset a loss of funds from the shrinking Illinois mining industry. Now, I would like to introduce the department heads or deans of the various colleges and universities and let them introduce the scholars. I'll start with the University of Missouri-Rolla: Dr. John Wilson.

John Lanzerotte, Chairman of Scholarship Committee introduces college representatives.

John Wilson: We have a very healthy program at U-M Rolla, I am pleased to say. A lot of that is a result of getting funds to attract well-educated men and women to our industry. We currently have 100 students in our program; the largest class in my five years at Rolla is graduating. All have been placed. I am sorry to say that fewer are going into the coal mining industry and even fewer into the state of Illinois. Maybe that will change. This year we have four scholarship candidates. We have three here today; unfortunately, the fourth couldn't make it. First, Daphne Place from Belleville, Illinois; she is a senior. Please come forward [Applause]. Then we have Scott Weinhold who is from Maryville, Missouri; he is a junior [Applause]. The third is Jeffrey Shaffer from Decatur, Illinois; he is a sophomore [Applause]. Simon Craft, the fourth recipient, is a senior from St. Louis, Missouri; he couldn't make it. We will be giving a report tomorrow morning about the things that are happening at the University of Missouri-Rolla mining program. Thank you.

Dr. John Wilson with scholarship recipients from University of Missouri, Rolla. Left to right: Scott Weinhold, Daphne Place, Dr. Wilson and Jeffrey Shaffer.

John Lanzerotte: Thank you, Dr. Wilson. Next I would like to bring up Lyle Cline with Southern Illinois University at Carbondale.

Lyle Cline: Thank you. I'm filling in for Dr. Chugh who is preparing for a trip to China next week. We, like Rolla, have had a growing group of young people come into mining, and we have placed everyone so far, not all of them in coal. We have been able to place our people; it takes a lot of time and a lot of climbing over rocks to do this, but we are working at it. I would like to introduce our scholarship recipients. A couple are not here. The first is Bradley Bingenheimer; I don't think Bradley is here. Kacey Grimes, a freshman, is here, and we are pleased to have her in our group [Applause]. The next is Mark Jones; Mark had a lab he had to attend. Jim Miller is here [Applause]. Jim spent the summer up at Springfield in one of the coal mines. He got a lot of good valuable experience there. Then we have Randall Rockrohr. I always call him Randy and it makes him mad, so I call him Randall now [Applause]. And the last is Rodney Sisk. I think Rodney had a lab today, too. Thank you very, very much.

Scholarship winners from Southern Illinois University, Carbondale. Left to right: Randall Rockrohr and James Miller.

John Lanzerotte: John Howard with Wabash Valley College.

John Howard: Thank you, John. On behalf of the administration, faculty-staff and students of Southeastern Illinois Community Colleges, I would like to thank the Institute for its continued support. We have three recipients this year. Two of the three are here. One had a sick child and was called to remove her from school (Gary Evans). But I will introduce the other two. Christopher Buchanan, a second year student attending at Southeastern Illinois College in Harrisburg and Jeremy Combs [Applause].

John Lanzerotte: And last is Chris Nielsen of Rend Lake College.

Chris Nielsen: I would like to thank the Illinois Mining Institute, on behalf of Rend Lake College, for its contributions to our scholarships. I am not the chairman of my department. He contacted me yesterday and said the president of the College had something he wanted him to do, and he wasn't going to be able to make the trip. So, he sent me instead. Our one scholarship winner this year from Rend Lake College is Robert Eovaldi [Applause].

John Lanzerotte: That concludes the awarding of the scholarships, and with that, I will turn the program back over to Mr. Dave Webb.

Dave Webb: Thank you, John. And thanks to the committee.

HONORARY MEMBERSHIP AWARD

Dave Webb: Our Honorary Membership Committee has made their selection for this year's honorary membership award. The chairman of that committee, Mr. Fred Bowman has requested that a close friend and fellow worker be allowed to present this prestigious award to this year's recipient. I would like to introduce Mr. Steve Bishoff, Manager of Environmental Engineering, Freeman United Coal Company. Steve.

Steve Bishoff: Good afternoon. As most of you know, each year the Institute elects an honorary member in recognition of that individual's contributions to the IMI and to the coal industry in Illinois. This year's recipient of that honorary membership is Mr. William Mullins.


Steve Bishoff (left) awards 1995 Honorary Membership certificate to William Mullins.

Mr. Mullins hired me about seventeen years ago to work in his engineering department, and since that time, I've come to know him rather well. So, I'd like to take this opportunity to just tell you a little bit about him. Mr. Mullins graduated from the University of Kentucky in 1951 with a bachelor of science degree in mining engineering. Subsequently, he held positions with Inland Steel and with the Elkhorn Coal Corporation before moving to the Midwest in 1966, when he took a position with Freeman United Coal Mining Company. At Freeman, Mr. Mullins held a variety of technical positions, including Chief Engineer, Vice President of Engineering and ultimately Senior Vice President for the underground mines, a position he held for the last five years of his career. In that position Mr. Mullins was responsible for production, engineering, maintenance and all peripheral services supporting the underground mining operations.

In addition to his long involvement with the IMI, Mr. Mullins was also an active member of the Society of Mining Engineers for well over two decades, serving on numerous Coal Division committees and as the 1984 Coal Division chairman. He was the Coal Division director on the SME board from 1985 to 1987, and he returned to the board in 1989 as the Vice President of Finance, a position he held until his retirement. In 1991, he received the SME Coal Division's distinguished service award. Mr. Mullins retired in 1991 after a career spanning more than four decades and almost 26 years at Freeman Coal.

On a more personal side, Mr. Mullins raised two fine children. He has several grandchildren, and he has an absolutely marvelous wife, Mary. I've always thought very highly of Mrs. Mullins because, besides the obvious support she always gave her husband, she always went out of her way to find some words of encouragement for the rest of us as well.

And as for Bill, I think that his greatest attribute is his relentless pursuit of excellence; his greatest contribution was in fostering that same attitude in those who worked for him. I can tell you that Bill is an excellent engineer and an excellent administrator. As a boss, he was a very good teacher, he was a very good coach and sometimes he was a pretty good referee as well. As my colleague for the last 17 years, he has been my very good friend. And so it is with great pleasure today that I am able to introduce this year's IMI honorary member, my friend, Mr. Bill Mullins [Applause].

William Mullins: Steve, thank you very much for those kind words. When I was informed of this award it took me almost two micro-seconds to decide that, after looking at the list of recipients, I would be very proud to join that group. I want to thank Steve for the introduction; it was exactly the way I wrote it, Steve. And I want to thank Fred Bowman and the selection committee for this honor. You can be assured that I will place this in it's proper place of honor next to the few other items of recognition that I have received over the years. Thank you very much [Applause].

Dave Webb: It is again the honor of the Illinois Mining Institute to be the forum for the Illinois Department of Mines and Minerals to recognize outstanding efforts in the area of reclamation and environmental achievement in Illinois. For this year's presentation, I am pleased to introduce Mr. Fred Bowman, Director of the Department of Mines and Minerals, who will present the reclamation award.

ILLINOIS RECLAMATION AWARD

Fred Bowman: As most of you know, our name has changed just recently. Again, this is an annual award given by the "Office" of Mines and Minerals in the Department of Natural Resources.

Fred Bowmam (right) of Office of Mines and Minerals awards Reclamation Award certificate to Don Goddard of Midcontinental Fuels, Inc.

The 1995 winner of the Office of Mines and Minerals Annual Reclamation Award in the coal category goes to Midcontinental Fuels and their president, Mr. Don Goddard; their operations are at Zeigler No. 4 mine near Johnson City. Midcontinental Fuels conducted a re-mining operation. Not only did they reclaim a rather environmentally hazardous area, if you will, they also allowed this same area, through improved conditions in water quality, to become a fish raising operation. As Don has told me, this year they will have very possibly 100,000 pounds of commercially-raised fish. In addition to the state award, they have received two very prestigious national awards, one of them given this week in San Antonio by the Interstate Mining Compact and another award by the National Association of State Land Reclamationists—two very prestigious awards in the area of land reclamation. And with that, I think Don Goddard needs our recognition for a job well done [Applause].

Dave Webb: Thank you, Fred. Today we have a team of luncheon speakers from the Illinois Coal Association. Mr. Joe Spivey, President of the Illinois Coal Association prepared an excellent speech today, but, unfortunately, he had surgery earlier in the week and could not get permission from his doctor to deliver his speech today in the event he might hurt the healing of his throat. So we have called upon the first Vice President of the Illinois Coal Association, Taylor Pensoneau, to deliver the speech today.

A little bit about these two fellows. Joe grew up in the area of Myrtle Beach, South Carolina. He served in the Marine Corps from 1960 to 1967. During that time, he handled assignments in numerous parts of the world, working primarily in security and intelligence. His marriage to the former Lois Thompson of Petersburg in 1967 brought him to Illinois. Not long after his arrival in the state, he immersed himself in a variety of political and public issue activities that gave him quick familiarity with the people and places of Illinois. He has served on many private and civic boards. Joe graduated from MacMurray College, majoring in political science and economics. From 1971 to 1973, he was director of Public Relations and Governmental Affairs activities for the Illinois Association of Electrical Cooperatives. After that, from 1973 to1976, he was the Executive Director of the Illinois Motel and Hotel Association. In 1976, he joined the Illinois

Coal Association, a Springfield-based trade organization representing coal companies in Illinois, government relations and other public affairs and related matters. Joe has been the President of the ICA since 1978.

Taylor Pensoneau is the Vice President of the Illinois Coal Association. Prior to joining the association in 1978, Taylor was a reporter for the *St. Louis Post-Dispatch* and spent most of this time in the bureau covering the Illinois statehouse where he wrote frequently on governmental and political issues. He grew up in Belleville, Illinois, where his family produced numerous coal miners. So if I could introduce Taylor Pensoneau to deliver Mr. Spivey's speech.

Taylor Pensoneau (left) and Joseph Spivey (right) of the Illinois Coal Association.

THE ILLINOIS COAL ASSOCIATION—PAST, PRESENT AND FUTURE

TAYLOR PENSONEAU[1]

Illinois Coal Association
Springfield, Illinois

INTRODUCTION

You know, you never can predict when or where Joe or I will be standing in for the other. When it happens, there's usually a good reason. This occasion is no exception. We talked about what explanation we would give about the switch here today. I was going to gloss it over, but Joe said that he wanted you to know the truth. So here it is. Joe's throat is still very sore from an operation that he had a few weeks ago, an operation that was necessary to eliminate some obstructions that were inhibiting his sleeping and causing some very loud snoring on his part. This damn snoring problem had gotten so serious that Lois, Joe's wife, had taken to sleeping in a separate room, a situation that wasn't auguring well for Joe's sex life.

So, I think you all can see that this operation, which has already led to some sound sleeping for the fellow we call Big Guy in Springfield, was pretty necessary. So, there you are, Joe, I told the truth.

Joe gets asked to make many speeches, but I can tell you that this one was an invitation that he really had welcomed. First, this was an audience of special people. Furthermore, there is nothing Joe, nor I for that matter, would rather discuss for a few minutes than the Illinois Coal Association (ICA).

Not too long from now, Joe will be observing the completion of two decades with the ICA. He and I have talked about writing a history of the ICA's role in this time. If we do it right, it could make for very good reading. This is because the last 20 years have been, to put it mildly, very eventful for the ICA and its member companies because of the heightened tempo of the challenges facing our industry in that period—an industry that always has had more than its share of ups and downs, as many in this room well know.

PAST

However, the history of the ICA goes back a lot further, back to at least the 1870s, as far as we can determine. The ICA has been on the front line for a long time in representing the coal industry in Illinois.

For the record, the Springfield-based ICA is the professional trade organization responsible for promoting Illinois coal. To do so, the ICA

[1] Taylor Pensoneau presented this paper on behalf of Joseph S. Spivey, President of the Illinois Coal Association.

represents the state's coal industry in governmental affairs, public relations and related matters.

The ICA is a not-for-profit corporation operating under policies set by the organization's Board of Directors, comprised of executives of the major coal mining firms operating in Illinois. The members of the ICA produce at least 90 percent of the coal mined annually in the state.

Trade groups, the banding together by individuals or companies for a common cause, are hardly new by any means. They existed at least as far back as the time of the Roman Empire, and maybe before then.

Many historians believe that the New York Chamber of Commerce, formed in 1768 by a group of 20 merchants, remains the oldest trade association still in existence in the United States. Coming along a little more than a century later, but still in the formative years of the world of American associations, was what is known today as the Illinois Coal Association. According to available records in the ICA office, the association was incorporated under Illinois law in 1878. Its principal office was said to be in Peoria.

In the many years of the association's operation, virtually everything has changed—the coal industry itself, the nature of the member companies and, quite obviously, the state and country. From the start, though, a basic objective has remained uppermost in the functioning of the ICA—the recognition by the membership of the need for cooperative efforts to protect common interests.

Back in the early days of the association in the nineteenth century, the organization showered much attention on the coordination of a transportation system for moving coal from mines to distribution points in cities and villages. Of course, coal was a primary source of heat for homes and businesses and for powering the industrial revolution in those years. By the end of the last century, coal had replaced wood as America's main energy resource.

Moving along into the twentieth century, the association's focus changed dramatically to cover the growing relationship between coal companies and the increasingly unionized miners. From the 1920s through the 1950s, the association, then known as the Illinois Coal Operators' Association, concentrated on a mix of issues tied to transportation, the negotiation of labor contracts, and the increasing encroachment of government into private business activity.

Furthermore, during those decades, the association was involved in some of the initial efforts at reclaiming land in Illinois affected by surface mining. Too, this was the era in which an arm of the association, the Midwest Coal Producers Institute, undertook pioneering steps in education and research related to the industry.

In 1967, the office of the association was moved from Chicago to Springfield as a prelude to a revision of the organization's role during the final decades of the current century. By the late 1970s, the organization was under fresh direction by a new president, Joe Spivey; had an upgraded focus; and even sported a new name, the Illinois Coal Association.

While the association's involvement in labor relations came to an end, greatly increased emphasis was placed on the ICA's stewardship of relations between the mining industry and the plethora of state and federal agencies regulating the industry more and more. As a corollary, the ICA has overseen a wide-ranging public relations program designed to bolster the image of coal and of the industry mining it. To an increasing extent, firms producing coal in Illinois have sought to deal with environmental and other issues affecting production through a single unified voice, that of the ICA. As a result, the voice of the ICA has been heard frequently the last 15 or so years in Washington and in many other places, in addition to Springfield.

In line with its promotion of Illinois coal, the ICA has fostered a broad range of unprecedented initiatives in concert with Illinois government and numerous university-related research agencies. One upshot of these undertakings is that Illinois has earned a reputation as the leader among the states in the development of research and demonstration programs intended to ensure a better long-range future for coal use.

PRESENT

So, there we not only have a short history of the ICA, but we have also gotten into the present. The present. What do you say about it? Well, if Joe Spivey and I ever write a book on our years with the ICA, we would like it to have a happy ending. However, we certainly can understand how that might seem like wishful thinking at this juncture to many of you at this lunch, as well as to many people in Pinckneyville and Harrisburg and all the other towns and places in this state tied to the fortunes of the coal industry.

No question, the immediate future for the coal industry in our state continues to be clouded by a troubled forecast. Farther down the line, the outlook well may include some rays of sunshine. Really, there is just too much at stake for everything for which we all have worked to just go down the drain.

As I said earlier, the long history of the Illinois coal industry includes many up-and-down cycles, numerous hills and valleys. You can see this by looking at the records. After the boom period in production traceable to World War I, the annual tonnage output in the state slipped steadily from the late 1920s right up to World War II. After shooting up during World War II, it gradually declined again over a 20-year period extending into the mid 1960s. From that point up until the last year or two, we were in a relatively positive stage in Illinois coal mining history, in which the average annual production hovered around 60 million tons. This year, the Illinois tonnage figure is probably going to be around 50 million tons, which would leave Illinois fourth or fifth among coal-producing states. However, our production is expected to fall further in 1996, and quite possibly, or even quite likely, the story will be the same in 1997. After that? We are guardedly optimistic that certain marketing and other factors coming into play may start to level the playing field for Illinois Basin coal.

Nevertheless, there is little debate that the mines in Illinois and the miners working in those operations are caught up in the still unfolding stage of what will be the most difficult period in Illinois mining since the 1950s and early 1960s.

Impact of Clean Air Act Amendment

Of course, the present downturn in the Illinois coal industry cannot be a surprise to anybody who has followed public events. We are being hit, as predicted by one and all, with the impact of the federal Clean Air Act Amendments of 1990.

Utilities purchase the bulk of the coal from Illinois and other states, and the 1990 legislation requires utilities using high-sulfur coal, like much of that mined in Illinois and other midwestern states, to reduce sharply sulfur dioxide emissions this year and again in 2000. To meet this mandate, some utilities have altered, canceled or refused to renew contracts with Illinois coal producers, opting instead for low-sulfur coal from western states or other fuel choices. Most of these actions have been taken by out-of-state utilities burning Illinois coal, a development magnified by the fact that roughly two-thirds of the coal mined in Illinois was bought in recent years by utilities in Missouri, Indiana, Georgia, Florida and various other states.

It is not uncommon these days at the ICA for Joe or myself to get calls, not just from reporters, but also others, asking if Illinois coal is on its deathbed. We answer that we do not think so—a logical answer because we both like our jobs. We try to explain that Illinois coal has faced sharp challenges before and that the industry has bent pretty far at times. But it has never broken down or capitulated. It will be back. Maybe not to what some consider boom times. But, we will be around. It will not be a cakewalk, though. We will have to keep fighting like hell to make our own breaks in the situation.

Even in the regulatory field in Springfield, there is change. The Illinois Department of Mines and Minerals, the state agency that regulated the coal industry since 1917, was merged into a new and broader department covering the entire natural resources spectrum. We were told that this was needed as part of an effort to streamline Illinois government, and we did not argue with this goal. But, we still worked to ensure that the crucial regulatory functions of the old agency were not compromised and that the image of the coal industry did not suffer as a result of the loss of an independent state agency for monitoring the industry.

It is important that we try to put as positive a spin as we can on developments like this because perception counts for so much as we strive to meet the challenges facing us.

FUTURE

Research and Demonstration

The future of coal, certainly in Illinois, revolves heavily around the meeting of challenges. First, I want to re-emphasize the importance of continuing the commitment by the state of Illinois to the broad range of research and demonstration programs that have made Illinois the leader among the states in efforts to bring about the cleaner use of coal. During the last 12 years or so, research entities, such as the Illinois State Geological Survey, have received grants totaling more than $40 million through the state's clean coal program. The state has committed close to $200 million out of its coal development bond fund for major clean coal demonstration projects or undertakings. In turn, these projects have attracted many millions of federal dollars.

The upshot of all this is that we are clearly showing that Illinois coal can be an environmentally acceptable, efficient and economical source of energy in the upcoming twenty-first century. Some of the Illinois coal now being mined and burned is attributable to clean coal technology programs, and a lot more of this will occur in the future.

The U.S. Department of Energy estimates that a substantial amount of new electric generating capacity must be built by utilities before 2010 to meet the expected increased demand for electricity. Much of this increased utility production will be fed by coal, and will include the introduction of even newer and more efficient clean coal technologies. Electricity paces our economic productivity, and coal paces electricity production.

There just should be no reason why coal's share in the growing electrical generation should not increase dramatically. But, without encouraging technological advances, particularly in combustion technology, coal may not maintain, let alone increase, its share of the generating market.

Utility Deregulation

Then we have the issue of utility industry deregulation, an increasingly hot topic in Illinois and other areas. Question marks galore surround the role for Illinois coal as some of our biggest utilities in the state along with many of their major customers push for greater consumer choice in a competitive utility marketplace. Could deregulation lead to a situation where a utility generating power with Illinois coal is permitted to compete in the same territory as an Illinois utility that charges its customers the highest rates in the state and burns no Illinois coal, like Commonwealth Edison? The Illinois General Assembly has sanctioned a formal deliberative process to come up with legislation on so-called utility regulatory reform—and the Illinois coal industry has been accorded a voice in the process through the ICA. Who knows what may come out of this?

Task Force on Global Climate Change

The ICA tries to have a hand in every issue that creates an opportunity or poses a threat for Illinois coal. Take the global climate issue. The drumbeats are familiar on this subject. A lot of the same folks who pushed the acid rain controls in the 1980s are crusading louder and louder for a governmental crackdown on something that is yet to even be proven as a viable issue, so-called global warming. Now, this is of course a national issue—one affecting the coal industry across the country, unlike the acid rain matter which essentially struck at the coal industry only in the Midwest. Nevertheless, in response to the clamor on this issue, the Illinois Task Force on Global Climate Change was set up a few years back to develop a formal Illinois action or game plan on this matter. The task force includes strong representation from the environmental community, which, guess what, wanted the issue to be addressed simply by heavy curtailment of the burning of fossil fuels in the state, especially coal. However, Governor Edgar also made sure the ICA had a seat on the task force. And, if you want to see what we do, I suggest you read the formal report of the task force that came out a little over a year ago. Although acknowledging that many of the greenhouse gas emissions come from fossil fuel combustion, the report meticulously pinpoints various energy efficiency and conservation programs and intensive forestation and other efforts to address this issue. Further impingements on the burning of coal are carefully skirted, though, a far cry from what certain potent interests wanted out of this task force.

CONCLUSION

The global climate panel is just one more reminder, though, that certain forces will never be satisfied until the mining and burning of coal becomes virtually extinct. But, it is also evident that the coal industry in this state has no intention of rolling over and playing dead. As noted earlier, we do bend at times, but we don't break. That's been the pattern, and it will remain so. The companies operating mines in this state—and they are among the finest in the United States—have a variety of means for insuring that there will be an Illinois coal industry. And one of those means is the ICA—both in the past and in the future.

You know, life is really interesting. In 1975, some 20 years ago, the *St. Louis Post-Dispatch* ran a featured article that pointed out that then Governor Dan Walker was basing the future of southern Illinois on the vast potential in the massive coal seams underlying the region. The article said that, and I quote, "Walker's planners foresee a rosy picture of mine tipples again dominating parts of the Illinois countryside."

Now, I know the guy who wrote that article, and he was a very accurate reporter. It was me. And besides, we were taught that you had to believe every word that was printed in the *Post-Dispatch*.

So, you see, Joe Spivey and I are still fighting to make that article come true. And, in fact, there is nobody in this room that doesn't want to see that article still come true. So, my final words of the day are simply the following: do not write us off yet.

Dave Webb: Thank you. I appreciate you both being here today. I understand that maybe "Big Joe" can answer a few limited questions after we get done here.

At this point, I would like to thank all the people who helped put this annual meeting together. Without all the volunteer work, the IMI would surely not survive. Also, I would like to thank all of the participants from the agencies, coal companies, everybody who really turned out. I, and a lot of the committees, were really fearful this year because of all the devastation that is going on in our market. I have to say that because of the support of everybody here, our exhibit hall is full, there are even exhibits outside. The attendance seems to be up to normal, maybe a little low or maybe a little high; too early to tell yet. But, we are right on track there. So, I think it is a real credit to the organization that we can keep things going at this time in this marketplace. Thank you very much.

Now I would like to introduce to you the incoming president for next year, the 104th year of the Illinois Mining Institute, Mr. Bert Hall.

Bert Hall: Taylor, I appreciate the comments about Joe. It looks like everything is going to work out pretty well. I wasn't quite sure where that story was going to go, but I'm glad it had a good ending. I want to thank you for the opportunity to be the incoming President for the Institute. I hope that I can carry on the same tradition as past presidents. Even more so, I hope to be able to follow in the footsteps of Mr. Dave Webb. He has been an outstanding president. During my involvement with the Institute over the years, I have found Dave to be one of the most dedicated, hard-working committed individuals of the Institute. With that, I would like to present Dave, on behalf of the Institute, with this souvenir gavel to remember his presidency [Applause].

President-elect Bert Hall (left) presents a souvenir gavel to outgoing President David Webb.

Dave Webb Thank you very much, Bert, for those nice comments, and we will be looking forward to seeing you next year. Heinz is going to make me give these announcements again real quick. We are still selling raffle tickets. It is real important to us to keep these funds coming in. So, please buy a lot. Zeigler Coal donated the airline tickets for a trip for two anywhere in the continental United States and Jim Justice of DuQuoin Iron and Steel is donating a set of golf clubs for raffle. So, please go up there and get those raffle tickets; they really help our cause.

If we have missed any members that have passed away since our last meeting, please stop by the registration desk so if we missed them here, we can honor them in our annual publication.

The Executive Board members will meet at 3:00 p.m. today at the Holiday Inn. So, if you are an Executive Board member, please look us up there in the conference rooms behind the front desk.

The convention floor is full. We really appreciate everybody stopping by and seeing what the vendors and suppliers have put together out there. There are even some exhibitors outside, we couldn't get room to put them all in.

We have another technical session starting at 11:00 a.m. Friday, right here. Bob Kudlawiec will be hosting that session. And we have a business meeting at 9:00 a.m. prior to that. So, if everybody could attend all that tomorrow, we would appreciate it. Thank you very much for your attendance. We are adjourned.

FRIDAY MORNING

Business Meeting

Friday, September 29, 1995—9:00 A. M.
LaSalle Room, Gateway Center

Dave Webb: Good morning. I am Dave Webb, IMI President. Welcome to our business meeting. I am going to call on Heinz Damberger, Secretary-Treasurer of the Institute to give the financial report.

President Dave Webb opens the Annual Business Meeting.

SECRETARY TREASURER'S REPORT

Heinz Damberger: The Auditing Committee has looked at our report and approved it. So, anybody who is interested, I have some copies here and you can either pick one up and take it home and study it or read it here. Let me just give you the basics. I am happy to report that we are doing very well as a result of some unexpected performance relative to projections. You may recall that last year the Board had decided to raise our dues somewhat and the advertising fees and also the cost of a booth here. Some of these things are showing up now in our financial statement, some will show up in next year's financial statement.

The major difference compared to what we expected is that our exhibitors came out in force. We have sold out the entire hall, which certainly was not expected when we made projections last year.

The main number that I always look at is the cash balance at the end of the year; it increased about $3,000. The main reason is exhibits. Looking down the road, I foresee a stable financial situation, certainly for the next two or three years, unless things change drastically.

We always make projections for the next year, which I present to the Board. Obviously, last year we were off quite a bit because we were very conservative. What I presented to the Board yesterday is again a conservative projection; yet we anticipate an increase in our cash balance by about $500. The main difference will be that we will have some increase from advertising and from dues. I decreased again the projection of the exhibits. I do not expect we will again sell out next year. However, our advertising committee is very active, so they may surprise us again. If we sell out next year again, we will have to think about what we do with the money, which is a very nice thing to do.

Our membership is fairly stable; we have been losing some members. It is really not anything dramatic. Attendance this year is almost the same as last year. We will have a total attendance probably of around 650 or 660 [actual attendance: 673]. Counting people who were pre-registered and have picked up their packets, and people who have walked in, we are at 613 at this point, Phyllis tells me. There are some people who have pre-registered who will still come this morning and pick up their packets, and there will still be some walk-ins this morning, I am sure. So, all-in-all, that is a very good situation as well. About half, or not quite half, of the attendance is related to exhibitors. Of course, they are always concerned about having attendance up because they don't want to talk to themselves.

Overall then, we are in good shape. If you have any questions, I'll be glad to answer them.

FINANCIAL STATEMENT SUMMARY

Cash Balance Beginning 9/1/94	$28,663	Cash Balance Ending 8/31/95	$31,625
INCOME		EXPENSES	
Advertising	17,258	General Operating Expense	22,432
Annual Dues	15,875	Annual Meeting Expense	22,046
Luncheon Receipts	2,055	Publication Expense– Proceedings	12,299
Exhibit Fees	25,818	Scholarships	10,000
Registration Fees	4,250	Mining History Fund	100
Short Course	300	Subtotal Expenses	66,877
Interest	899		
Mining History fund	235		
Centennial Souvenirs	145		
Convention Raffle	1725		
Miscellaneous	129		
Vendor Fees	450		
Convention Cash	700		
Subtotal Income	69,839		
TOTALS	98,502		98,502

ASSETS AS OF AUGUST 31, 1995

Fixed Assets		
Office Equipment & Furniture		13,203
Liquid Assets		
Cash	31,625	
Bonds	500	
		32,125
TOTAL ASSETS ON 9/1/95		45,328
TOTAL ASSETS ON 8/31/94		41,994
1994-95 GAIN (Due to increased exhibit fee revenues at Annual Meeting)		3,334

Dave Webb: Thank you, Heinz. I am wondering if we can get a report from the Nominating Committee for the election of officers and Board members. George Woods, as chairman of that committee, would you like to step up and give a report on that subject?

NOMINATING COMMITTEE REPORT

George Woods: The Nominating Committee, myself, Bob Shanks and Bill Noel, recommends the following slate for next year:

President:	Bert Hall
First Vice President:	John Lanzerotte
Second Vice President:	Greg Bierei
Secretary-Treasurer:	Heinz Damberger

For new members to the Executive Board:

Greg Bierei, Arch of Illinois
Jeff Hayden, White County Coal Corporation
C. K. Lane, Old Ben Coal Company
Steve Rowland, Kerr-McGee Coal Corporation
John Hill, Marissa Business Unit, Peabody Coal Company to replace an Executive Board member who resigned

Dave Webb: Thank you, George. Do we have any candidates that would like to apply for any of those positions at this time—walk-on or write-in candidates? If not, I assume we have to have an election on those recommendations from the Nominating Committee. So, anybody opposed? [No negative votes were cast] Well, we have a new set of officers and Board members.

ADVERTISING COMMITTEE REPORT

Dave Webb: I talked with John Payne of the Advertising Committee in the exhibit hall this morning. Chairman Joe Pileggi is not here this morning, but I have talked to the Advertising Committee, and I think they did a fine job. The exhibit hall was completely sold out, and everything is in good shape for advertising in our publication.

I wish to thank all of the subcommittee chairmen for all the work you have done this year on behalf of the Illinois Mining Institute.

Now, I would like to introduce John Lanzerotte, Chairman of the Scholarship Committee.

SCHOLARSHIP COMMITTEE REPORT

John Lanzerotte: I would just like to talk a little bit about the IMI scholarship fund. Again, the Board graciously made the decision to keep the scholarship fund at $10,000 for the 1995-96 school year. Those dollars were allocated to deserving students at regional colleges and universities. That included $4,500 to Southern Illinois University at Carbondale, $3,500 to the University of Missouri at Rolla, $1,500 to Wabash Valley College, and $500 to Rend Lake College. Again, these dollars go a long way toward helping these schools and universities to attract and retain the best students. And as I said yesterday, the amount of mining company support for these programs has been diminishing, obviously as the total mining industry has decreased in size over the last few years. I would also like to thank the Scholarship Committee, George Woods, Dr. Paul Chugh and Dan Ganey, for their assistance and support.

At this time I would like to let the department heads or deans of the various universities stand up and just say a little bit about the current activities and programs at their schools. Dr. Chugh.

Southern Illinois University

Paul Chugh: Thanks John. Let me begin by saying that we thank IMI for supporting the academic programs and your confidence in us. I am pleased to report that the department is in excellent academic and financial health and has the support of the University and the College administration.

Let me be more specific now. In the undergraduate program area, we have 30 juniors and seniors, mostly from the community colleges. We do not go to the high schools to recruit. We basically recruit from three community colleges: Shawneetown, John A. Logan and Rend Lake. We are also trying to recruit students in the double majors electrical-mining and mining-mechanical. And they are our hot sellers. We graduated six students this May; everyone was placed. We will be graduating two students in December, and they are already committed. So, we are doing a fairly good job of working with the industry, trying to develop what we call industry-oriented programs. The students seem to be doing very well and are well received in the industry. The industry is telling us to produce more dual-degree majors because that is going to be the demand in the future.

Our summer program is doing very well. We placed eighteen students this summer. Every student who wanted a job in the summer was placed.

In the graduate program, we have 20 students; about one-third of them are U.S. citizens and the others are non-natives. The native-born graduates are finding jobs in the consulting area. One of our students yesterday told me he got a salary of $60k in the consulting area. So, I think we are doing something good in that area. Most of the non-native graduates are going on for the Ph.D. programs. We are trying to do something in the business-mining area combined.

In research, we are very active and quite successful in attracting funds from the U.S. Department of Energy, the industry, and the state. I'll be presenting a little bit later on today, two technologies we hope to commercialize for our industry within the next 12 to 24 months. There are two areas we are very active in right now: coal processing and management of coal combustion by-products. Coal combustion by-products, disposal and utilization is probably the most important problem facing us, and we hope to have some technologies for our industry developed.

Let me summarize once again. On behalf of Southern Illinois University, the Department of Mining Engineering, we do thank you for supporting our academic programs and hope you will continue to do so. We are going to try to provide some good students who can be the future of the coal industry in this area. Thank you again.

John Lanzerotte: Thank you, Dr. Chugh. Does that consulting firm have any more openings? Next I ask Jerry Tien of the University of Missouri, Rolla.

University of Missouri–Rolla

Jerry Tien: Thank you, John. I want to apologize for John Wilson, our Deparatment Chair. Something happened a few days ago that required him to be somewhere else today for a meeting in Columbia [Missouri]. Thank you very much for the scholarship funds provided for our students. We cannot thank you enough for that. Those scholarships attract good students and have been quite helpful to us.

Now, I am going to report to you something that happened this week in the following areas. I will spend a few minutes talking about UMR campus-wide, the Mining Department and finally a few other things.

At the campus level, UMR has been following a five-year strategic plan. Just like all the industry people, we are looking at things a little more critically and we are under very much closer scrutiny; so they are looking at each and every department very closely. For the past two years or so, UMR has participated in the Missouri Quality Award. I am happy to report to you that UMR made that short list this year, and we are expecting a visiting team from the state next week. We are continuing to try to improve the quality of our students. I am wondering if you have read the recent issue of *U.S. News and World Report* which says that UMR is one of the top engineering universities in the United States. We were very happy to see that.

As for the Mining Engineering Department, we are doing very well. We currently have 97 undergraduates and ten graduate students. We have in the past made a conscious decision to put more emphasis in the undergraduate level as opposed to the graduate, because that is what the industry told us they want: more well-rounded mining engineers at the undergraduate level.

In regard to placement, just like SIU, all students this past spring were placed in good jobs. They got jobs all over the place: quarry, coal, metal, non-metal, equipment manufacturers and so forth; just a diversified situation.

We try to stay at the current level of enrollment. This is based on the availability of our faculty and staff and the equipment. Also, the student enrollment level is pretty much defined by industry: how many students you need. We don't want to graduate so many students that we can't find jobs for them.

Our student body is pretty active, and we always try to encourage them to participate in activities such as IMI and all the SME functions, national and local chapters, such as the Southeast Missouri chapter and also St. Louis chapters. Last April, we hosted an intercollegiate mining competition, and we did very well. Thirteen teams participated; both our men's and women's teams did very well. The mine rescue team had a competition last year as well, in Louisiana. Out of 15 teams, UMR was seventh, which is not too bad considering that we were competing with professionals. We are going to have another competition next week. I just talked to some vendors who are coming to UMR for another mine rescue competition.

Carrying on our tradition, we have bi-weekly SME meetings; our student chapters of SME have invited industrial speakers to provide contact with our students, and we feel that has been very beneficial. The students get to know what is going on in the industry and the industry gets to look at our students.

We do a lot of recruiting in high schools. We went to Jefferson City, our capital, to take part in a legislative day and had an engineers' night in Rolla. Dr. Wilson was there, I presume, last night to participate in the promotion.

Some of you who have come to our campus on Tuesday might know that our mining students are out there selling bratwursts. We are trying to raise funds for needy people in Rolla; this is a good activity for the students to get involved in. All of our students found summer jobs this past summer. We have at least four coop students, one in Black Diamond Coal, Bill Podrazik; one in industrial minerals in Arizona, Chris Baer; and one young lady who was working for about a half year for MSHA in southeast Missouri, and also another fellow, Don Taggert, who works for Twenty-Mile Lime in Colorado. He just came back to school. We feel that it is also very important to have cooperative education.

Seven undergraduates will graduate this coming December and fifteen in May. Our big test is to place all of them. But we feel relatively confident. We already have a lot of related activities. Companies which never came to the UMR campus before are coming in the next couple of weeks or so, including seven or eight mining companies.

Some comments on the academic program and faculty activities. You might be aware of the Quenon Chair; a chair for Mr. Quenon, a former Peabody president, which has been recently created; it needs to be filled in the near future. Dr. Charles Haas, who has been with us for a long time, is to retire next May. He will be replaced.

We have always been very active in the continuing education area. In the past eight years, I have been teaching the mine ventilation short courses. We want to thank Kerr-McGee, Monterey Coal and other companies for their support. We will be doing that again next May. I have already had four requests, which is not too bad, considering I have not announced the next date yet.

The past few years, Paul Worsey has been teaching an explosives course in cooperation with the Army at Ft. Leonard Wood; it has been been quite successful.

Dr. John Wilson has gone to Chile twice this past spring conducting some environmental protection short courses.

We have always placed a lot of emphasis on our field trips. This is very important for courses such as underground mining and surface mining. We even do that with the very beginning course to make sure that those who come to our department take an introductory mining course, and visit an operating mine. Thanks to the companies again for their support; we will call on you again for field trips.

Again and again, industry has come to us to tell us to make sure our graduates have computer ability. We have increased our popular computer mining package software courses. We have programs such as SURPAC 2000, and people from Datamine come to our campus to do a one-week short course to instruct our faculties and students. We also have used quite a bit the CPS PCs package. We had the CAMERA of Madisonville, Kentucky coal package and SHERPA for surface mining design and also APEX for economic analyses and feasibility studies. We use Autocad quite extensively. Our computer lab also has Caterpillar's design package, dealing with haulage calculation, haulage design and equipment selection. So lots of our computer packages are being used.

We continue the research with ICCI in cooperation with the department. We are trying to pelletize fine coal; and we have also done a lot of research in the past year under John Wilson's direction, on the coal log pipelines. Some work is being done in the areas of explosives and rock mechanics.

The recent loss of the U. S. Bureau of Mines will affect some of our programs; however, we don't expect it to have a major impact on us.

Let me now discuss very briefly some of the other activities. John and I were involved in last year's four-month long training program for the Chinese coal project. We went to China to visit several Chinese coal mines; we gave lectures and talked to their engineers. That is an interesting experience for both of us. I mentioned earlier that John went to Chile to advise on environmental protection programs and explosive programs. We are also having quite a success on an exchange program. Right now, we have three students in Australia; they are going to send three mining students to our program. This is quite interesting and exciting for us and we are working on two other programs with South America and South Africa.

We are also anticipating several exchange scholars from China next spring and summer.

We are somewhat affected by the drop of scholarship funds as a result of the weakened coal companies. We really have to work hard and need your support for scholarships because they are important to attract good students.

Our department will remain pretty much the same in the foreseeable future. We are trying to meet industry demand in terms of quality and quantity of our students. Our enrollment will stay at the current level; we don't want to extend more than we can handle. Also at the university there is a critical mass; you don't want to get too few. So, we are going to stay at the current level. We try to be one of the best well-rounded mining programs in the United States, perhaps in the world. Mining is going global, and we try to prepare our students to look beyond their neighborhood.

Again, thank you very much for the opportunities; we appreciate it.

John Lanzerotte: Thank you, Jerry, for that report. Chris Nielsen with Rend Lake College couldn't make it here today The last school to hear from is Wabash Valley College and George Woods.

Wabash Valley College

George Woods: We would like to thank the IMI for its continued support of our students with this scholarship. As John mentioned earlier, Wabash Valley received $1,500 this year, and we distributed that among three students at our location at Southeastern Illinois Community College in Harrisburg. Two of our scholarship recipients were here yesterday during the luncheon; a third could not make it. I'd like to mention their names again: Gary Evans from Harrisburg, Jerry Combs from Crossville and Christopher Buchanan from Carmi. Each received $500. Five hundred dollars is real important to these students in that $500 at the community college level represents about a third of the cost of a two-year degree in tuition. So it is a substantial scholarship, and we thank you very much for that.

Let me mention a couple things about our program. We have about 20 students pursuing an associate degree in coal mining technology at our Harrisburg location. We are also very active throughout the state with mining. We have five locations in which we serve the mining industry: Wabash Valley College at Mt. Carmel, our site at Harrisburg; John A. Logan College at Carterville; Belleville Area College in Marissa, and in Springfield we have a location at Lincoln Land Community College. We have 13 full time mining instructors so it sounds kind of funny when I say we only have 20 students. Most of our instructors are involved in annual re-trainings, electrical re-trainings and skills training We still do a lot of teaching in hydraulics, electrical, mechanical welding, as well as numerous health and safety programs. These include a variety of special classes in drug and alcohol abuse, and an intensive stretch and flex program with Kerr-McGee

Coal. So we are staying very active in the mining industry. We hope to serve the industry for many years to come. Thank you again for your support with the scholarships.

John Lanzerotte: Thanks George. That concludes the report of the Scholarship Committee. So, I would like to turn it back to Dave Webb.

Dave Webb: Thank you John and to all the universities for showing up and reporting here yesterday or today. Most of the scholarship recipients were here, yesterday, of course; they received their awards. A fine lookin' bunch of students.

Is there any other business from the floor? Any suggestions? Ideas for future meetings?

OTHER BUSINESS

Paul Chugh: Jerry Tien mentioned the Bureau of Mines, and perhaps I can brief you a little bit as to where that situation stands. I have been in touch with the Bureau of Mines since the Appropriations Committee met last Wednesday, and I guess things are not totally clear as to how the Bureau of Mines programs will be managed in the future. Let me share with you some of the things that I know of as of this minute. The Pittsburgh Mining Research Center will merge with the Fossil Energy program of the U.S. Department of Energy. A portion of the Spokane Mining Research Center will also go into the Fossil Energy program of the U.S. Department of Energy. A portion of the Denver Mining Research Center will go with the U.S. Geological Survey's Mineral Information program. Regarding the Twin Cities Research Center programs: nobody is sure what is going to happen. Some discussions are going on, but I don't know for sure whether the programs will be moved into the Department of Energy completely, or if the U.S. Department of Labor will get involved in the Bureau of Mines programs. Everything is in a fluid state. I think it is definitely going to impact mining education and mining research. The thing that I have been talking to the industry about is that it is time for the industry to become much more active in research, either on their own or through cooperation with universities, so that we can maintain the best technology to produce coal and aggregate at the cheapest possible cost and remain competitive in the global market. We are really sad to hear that the Bureau of Mines, the name itself, will be wiped off the slate; but I guess that's America. We just have to start thinking about how do we rebuild our strength because we definitely need research and development in order to stay competitive globally. That is the best information I have as of this minute, and I'll try to keep you posted through our regional contacts or through meetings like this. Thank you.

Dave Webb: Thank you Dr. Chugh. One thing I might mention: our honorary member for this year was Mr. Bill Mullins; he received his award yesterday at the luncheon.

Is there any other business? If not, I would like to invite you all to our technical session a little later here in this room. It will be hosted by Mr. Bob Kudlawiec of Cyprus AMAX Coal. We have a continental breakfast in the exhibit hall. All the exhibits are still set up, so we encourage you to go see what is available, if you haven't yet. That concludes this morning's business session. Thank you for attending.

TECHNICAL SESSION II: PROCESS INNOVATION IN COAL CLEANING AND USE

Friday, September 29, 1995
LaSalle Room, Gateway Center

Dave Webb: Good morning, my name is Dave Webb, President of the IMI. I would like to introduce the chairman of the Technical Session this morning, Mr. Bob Kudlawiec, Maintenance Manager, Wabash Mine, Cyprus AMAX Coal Company. Bob.

Robert Kudlawiec: Good morning. Thank you for attending the session. Our first speaker is Dr. Paul Chugh, Professor and Chair of the Mining Engineering Department at Southern Illinois University. Dr. Chugh's background is a bachelor's degree, a master's degree and a Ph.D. from Penn State University. Dr. Chugh has seven years in the mining industry and 27 years in teaching and research. Dr. Chugh.

Paul Chugh: Thanks very much for the introduction.

Chairman Robert Kudlawiec opens the Friday technical session.

MANAGEMENT OF DRY FLUE GAS DESULFURIZATION BY-PRODUCTS IN UNDERGROUND MINES—AN UPDATE

YOGINDER P. CHUGH AND EDWIN M. THOMASSON

Southern Illinois University
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BACKGROUND

In 1993, the U.S. produced about 100 million tons of coal combustion by-products (CCBs) primarily from conventional coal-fired boilers. The requirements to reduce SO_x and NO_x emissions to comply with the 1990 Clean Air Act Amendments (CAAA) forces utilities to adopt advanced combustion and flue gas desulfurization (FGD) technologies, such as wet scrubbers, fluidized bed combustion (FBC), dry sorbent duct or furnace injection. These technologies will double to triple the amount of FGD by-products while only slightly increasing the amounts of conventional combustion residues, such as fly ash, bottom ash and boiler slag.

FGD technologies may be dry (dry sorbent duct injection, furnace injection, FBC) or wet (scrubbers). The dry FGD technologies may be the economic choice for older, smaller units with insufficient space for retrofitting with wet FGD systems. Some of the new plants may favor wet scrubbing technologies. The FGD by-product materials consist of calcium-, magnesium-, or sodium-based excess sorbent reaction products containing sulfates/sulfites, fly ash, and calcium hydroxide. The dry FGD by-products typically have a high lime index (percent calcium hydroxide) of 20 to 30 percent and cementitious properties.

About 75 percent of the fly ash, bottom ash, and boiler slag and almost 100 percent of the FGD by-products are disposed in surface facilities near the power plant or landfills; only a small amount is disposed in surface facilities near mines. Underground disposal of FGD by-products overcomes most of the disadvantages of surface disposal. Furthermore, underground disposal, if properly managed, offers significant potential for mitigating subsidence and acid mine drainage. The U. S. Department of Energy (DOE) therefore emphasizes management of FGD by-products alone or in combination with by-products from other processes, such as wet scrubbers and coal processing residues.

In Illinois, about three million tons of dry scrubber sludge (or 6 million tons of wet scrubber sludge) and 0.5 million tons of FBC residues are produced annually. Demonstration studies are currently underway to evaluate the use of dry-sorbent duct and furnace injection technologies. About 7,000 megawatts (MW) of additional capacity is expected to be wet scrubbed in the near future in response to the CAAA, which will increase the amount of wet scrubber sludge. Therefore, technologies need to be developed and demonstrated for environmentally sound management of wet scrubber sludge, fly ash and FBC residues in underground mines with the additional potential benefit of control of subsidence and/or acid mine drainage. Subsidence over abandoned mines is a major issue in the Illinois Basin states.

On September 30, 1993, the U.S. Department of Energy-Morgantown Energy Technology Center (DOE-METC) and the Department of Mining Engineering at Southern Illinois University at Carbondale (SIUC) entered into a cooperative research agreement entitled "Management of Dry Flue Gas Desulfurization By-Products in Underground Mine." Under the agreement, SIUC will develop and demonstrate several technologies for the placement of coal combustion by-products (CCBs) in abandoned underground mines and will assess the environmental impact of such placement. The overall program set forth in the cooperative agreement is for a period of four years, beginning October 1, 1993. The program is divided into three phases, as follows: Phase I, Mix Development and Characterization; Phase II, Surface Demonstrations; and Phase III, Underground Demonstrations. Placement of FGD by-products underground will be demonstrated at Peabody Coal Company's No. 10 mine.

This paper provides an update on the progress of this cooperative program between several organizations, including the Office of Coal Development and Marketing of the Illinois Department of Commerce and Community Affairs, the Illinois Clean Coal Institute, the Illinois State Geological Survey, the U.S. Bureau of Mines, SEEC, Inc., Eric Powell and Associates, Mine Systems Design, Inc., Illinois Power, Springfield City Water, Light and Power, Archer Daniels Midland, Peabody Coal Company, Illinois Central Railroad and Norfolk Southern Railroad. A steering committee, consisting of representatives of the Illinois Clean Coal Institute, the Illinois Environmental Protection Agency, the Office of Mines and Minerals, the Office of Coal Development and Marketing, Peabody Coal Company and the Illinois Coal Association, provides oversight to the project.

OBJECTIVES

The objectives of the cooperative program are:

Develop and demonstrate one or more methodologies to handle and transport dry coal combustion by-products which are technically and economically feasible and will alleviate the fugitive dust problem.

- Develop and demonstrate a pneumatic placement technique to dispose of coal combustion by-products (and mixtures of various by-products) in abandoned underground coal mine workings from the surface through a borehole, utilizing dry by-products. The methodology developed should distribute the by-products over an area of at least 300 feet from the injection borehole.

- Develop and demonstrate a technology to dispose of coal combustion by-products (and mixtures of various by-products) in abandoned underground coal mine workings from the surface through a borehole utilizing a mixture of by-products and water in paste form so that the paste contains approximately 70 percent residue solids. The methodology developed should distribute the by-products over an area of at least 300 feet from the injection borehole.

- Determine whether the placement of coal combustion by-products in abandoned underground coal mine workings, using either a pneumatic placement technique or a paste hydraulic backfill will control surface subsidence over the abandoned underground workings.

- Assess environmental impacts (land, water, air) of underground management of FGD by-products.

COMPONENTS

The Program has been subdivided into the following components: 1) residues and mix characterization, 2) underground placement, 3) materials handling and transport , 4) environmental assessment and monitoring and 5) field demonstrations. The progress in several of these component areas over the past two years (October 1, 1993 to September 30, 1995) is reported in the following sections.

PROGRESS TO DATE

Overview

Virtually all laboratory tests on environmental properties of CCBs mixtures have been completed, including TCLP, ASTM and modified SLP shake tests, and ASTM column leaching. Long-term column leaching tests, designed to continue for at least one year, are underway. All tests to date indicate that the individual coal combustion by-products, as well as the by-product mixtures, are non-hazardous in character and unlikely to have any adverse affects on the environment or on groundwater at the underground placement site.

Finite element analyses of long-term stability of room-and-pillar mine workings at the Peabody No. 10 mine was utilized to determine strength and deformability requirements for mixes to control surface subsidence. The estimates of these parameters were determined to be about 160 to 200 psi and 10,000 to 12,500 psi, respectively.

Two mixes suitable for pneumatic placement have been identified that involve FBC fly ash and FBC spent bed by-products. Similarly, two mixes for hydraulic placement have been identified involving wet scrubber sludge, F-fly ash and lime.

Work on material handling and transportation of coal CCBs by various means was completed, including use of pneumatic trucks, pressure differential rail cars and collapsible intermodal containers (CICs), as well as a study of the economics of handling and transportation. A full scale field demonstration of the collapsible intermodal container technology was completed for the handling and transportation of CCBs.

All necessary wells were completed at Peabody No. 10 mine, including two injection wells, two geotechnical wells, and two vent wells (which can be used as further injection wells if necessary) and groundwater monitoring wells. A borehole television camera provides pictures of the underground mine area; they show that the areas are dry and the wells are suitably located in void mine space.

Surface subsidence monuments have been installed, and periodic observations are being made to provide background data on surface subsidence and the rate of subsidence over the placement area.

Groundwater samples are being taken and analyzed to provide background baseline data.

At the close of the year, the DOE granted additional funding to be used for the development and testing of technologies for the handling and transportation of CCBs. The Illinois Central Railroad and Wilson Manufacturing Company will be cooperating in this undertaking. Preliminary plans call for the modification of existing steel intermodal containers so that they can be used to handle and transport CCBs. Rail hopper cars will be modified for the same use. One or both technologies will be fully tested under plans now being developed.

Residues and Mix Characterization

Environmental characterization of by-products was undertaken so that predictions can be made of the environmental effects of the placement of such by-products in underground coal mines. The FGD by-products include PCC F-fly ash, FBC fly ash, FBC spent-bed and force-oxidized wet scrubber sludge. This section describes the nature of the leachates produced by the by-products both in the short term and over longer time.

The mix selected for pneumatic placement consists of 80 percent FBC fly ash and 20 percent spent bed ash treated with 30 percent moisture during injection. The paste backfill mix for hydraulic placement consists of 55 percent force oxidized scrubber sludge, 40 percent F-type fly ash, and 5 percent venturi scrubber sludge (lime waste).

The potential for flue gas desulfurization by-products to introduce contaminants into the groundwater depends on several factors relating to the material itself. These factors include: bulk composition of the material to be placed, mineralogical structure, permeability and amenability to alkaline or acid side leaching conditions.

Material Composition: Samples of each of the major by-products were subjected to microwave digestion in a solution of nitric, hydrochloric, and hydrofluoric acid (aqua regia & HF). The solutions were neutralized with boric acid and analyzed by ICP. Samples were also analyzed by long capture time SEM. These studies were supplemented with preliminary XRD analysis to identify mineral phases. Trace elements of environmental concern are present only in limited quantities in all of the by-products being considered for underground placement. A more detailed discussion of the available data is included in Chugh, et al. (1995).

Permeability of the Material: In assessing environmental impacts from leachate emanating from the FGD by-products fill, an important consideration is the relative amount of leachate to be released. A very small quantity released into a much higher volume groundwater system may have no impact because of dilution.

All of the FGD materials in this program are fine-grained and, when tightly packed, have fairly low hydraulic conductivities. Estimated initial hydraulic conductivities for scrubber sludge, PCC fly ash, FBC fly ash, FBC spent bed are 40×10^{-6} cm/sec, 6.5×10^{-6} cm/sec, 20×10^{-6} cm/sec, and 15×10^{-6} cm/sec, respectively. Proctor tests were performed and PCC fly ash and force-oxidized scrubber sludge were both packed at the optimum moisture and density as specified by ASTM. The FBC fly ash and spent bed CCBs were not amenable to the ASTM procedure.

At the Peabody No. 10 mine, the coal and surrounding rocks have hydraulic permeabilities in the 10^{-8} to 10^{-9} cm/sec range. FBC materials have been tested in triaxial cells and found to reach these low hydraulic conductivity values when placed at the Proctor density. It seems rather unlikely that paste flowing loosely through an opening or material pushed into place by surges of air will reach these densities. For this project, both mix materials will be more permeable than the surrounding rock layers and will be a preferred path of water flow through solid. Because the openings will not be completely filled, there will be voids above the fill where hydraulic conductivity will be infinite by comparison. Early indications at the site are that the hydraulic gradients at the mine are extremely small. This would mean that total leachate volumes will be small, though the potential for dilution may be related to flows in the void space above the material, more than to flows in the surrounding rock.

Risk of Acid Side Leaching: Fly ashes in particular are known to contain elements of environmental concern, including Cr, Cd, As, Se, and Pb. Most of these elements are likely to leach in higher concentrations in an acid environment than in an alkaline environment. Paste pH measurements are normally used to indicate whether by-products are alkaline or acidic. Because of the 40+ percent calcium oxide content of the FBC ashes, these produced paste pHs of 12.25 and 12.36, respectively. The proposed pneumatic mix gave a paste pH of 12.26. The PCC F-type fly ash produced a curious result; the alkali in this ash seemed slow to mobilize. In several experiments, after 5 to 10 minutes, the pH appeared to be in the 3.5 to 3.7 range. The paste pH finally stabilized at 11.78. The experiment was repeated four times for confirmation. From previous long-term open column leaching tests it was known that the pH values of leachates from this ash were in the 7.5 to 8.5 range.

To confirm the possibility that fly ash alkali release may be sluggish compared to other materials of similar composition, a pond containing over one million gallons of very acid mine water was treated with the same FBC fly ash proposed for the pneumatic mixes at the Peabody No. 10 mine. The FBC fly ash has a calcium carbonate equivalent (CCE) value of 71, as determined by the agricultural lime method. In both the field setting and bench top laboratory experiments, it took twice as much FBC fly ash to neutralize the water as was calculated by the CCE and acidity of the water. Both experiments were done under fairly quiescent water conditions. These results are important in developing mixes for acid mine drainage control.

Geotechnical Characterization of Mixes

The characterization of mixes for pneumatic and hydraulic placements includes short- and long-term strengths, elastic moduli, stress-strain characteristics, swelling and slump characteristics, linear expansions, heat of reactions, mass loss at extreme temperatures, and density. Hydraulic placement of CCB and FGD by-products in abandoned mine workings may negatively impact the stability of mine workings and surface subsidence since Illinois coal seams are generally associated with thick (2 to 4 ft) and weak (300 to 1,000 psi) floor strata. Short-term subsidence due to wet backfilling can cause damage to surface structures and impact land use patterns. In addition, the stability of underground bulkheads may be negatively impacted due to active pressures imposed by hydraulic or pneumatic placement of by-products. The results of the demonstration studies at Peabody No. 10 mine will be generalized for other areas within the Illinois Coal Basin.

Finite Element Modeling: The causes of subsidence on the surface in the Illinois Coal Basin are the weakening of floor strata, resulting in floor heaves, and pillars punching into weak floors, resulting in pillar and roof failures. The finite element modeling was conducted to determine the amounts of floor heave, roof sag and pillar punching over a period of time, with and without backfilling. If the backfilling can reduce floor heave, roof sags and pillar punching, then it should reduce the subsidence on the surface. Also, reductions in floor heaves, roof sag and pillar punching due to partial backfilling and backfilling with different material stiffness were investigated using finite element modeling. The model was formulated as a large displacement, small strain problem with geometric non-linearity. All the strata in the model are assumed to be linear elastic except the immediate floor. The immediate floor is assumed to have time-dependent behavior.

The modeling procedures involved two sets of steps, one without any backfill and one with a backfill material. The first set of steps involved: 1) applying pre-mining stresses to the model without any opening, 2) excavating all the openings simultaneously within 30 days to simulate formation of entries. Redistribution of the stresses that occur and vertical displacements in the roof and floor are determined due to the creation of openings, and 3) running the model to simulate nine years at an increment of 30 days.

In the second set of steps, the excavations were created as before but the openings were backfilled after one year. The backfill material was brought stress-free into the already deformed openings. The model was run for nine years and stresses and strains were updated at an increment of 30 days. Floor heave, roof sag and pillar punching were determined from vertical displacements.

The results showed that the maximum compressive stress on the backfill material was between 60 to 170 psi. The reduction of floor heaves, pillar punching and roof sags can be attributed to the confinement provided by the backfill material. The failure of the backfill material when placed underground is negligible because the stresses on it are very low. The analyses show that a weak backfill material can effectively reduce floor heave, roof sag and the amount of pillar punching into the floor, which, in turn, can reduce surface subsidence.

Pneumatic Mixes: Out of 16 initial trial mixes, four mixes of different proportions were selected for further geotechnical characterizations. The mixes were 80-20 and 70-30 (FBC fly ash and spent bed) with 25 percent and 30 percent moisture with 25 psi compaction pressure. The average demolded densities were 71 and 73 pcf for 80-20 and 70-30 mixes, respectively, with 25 percent nominal moisture. The same mixes with 30 percent nominal moisture have average densities of 71 and 75 pcf, respectively. The 28-day compressive strengths of 80-20 and 70-30 mixes with 25 percent nominal moisture are 11 and 3 psi, respectively. The same mixes with 30 percent nominal moisture have average strengths of 92 and 34 psi, respectively.

The pneumatic mixes finalized are to have either 80 percent FBC fly ash and 20 percent spent bed, or 70 percent FBC fly ash and 30 percent spent bed with 25 to 30 percent moisture. Considering the current production of FBC fly ash and spent bed, a 80-20 (fly ash-spent bed) mix is more desirable.

With 30 percent added water, compressive strength of 90 to 100 psi is expected after a 28-day curing, with elastic modules value of about 5,000 psi. Similar values for 90-day strength are about 140 psi and 8,000 psi, respectively.

Hydraulic Mixes: Paste backfill requires mixes with little or no bleed-off characteristics during the setting process. In cooperation with Mine Systems Design, Inc., the following mix was identified for hydraulic placement: fly ash, 40 percent; scrubber sludge, 55 percent; lime waste, 5 percent and water, 29 percent. The average compressive strengths and elastic moduli values were 184 psi, and 10,100 psi for 25 days curing time.

Two groups of samples were also tested for long-term strength, one with 29 percent water content and the other with 31 percent. The average values of compressive strengths and elastic moduli after 35 days of curing were 184 psi and 10,100 psi and l58 psi and 9,900 psi, respectively.

UNDERGROUND PLACEMENT

Pneumatic Backfilling System

The pneumatic placement system is being developed in cooperation with the University of Pittsburgh and Eric Powell and Associates. A novel concept of applying high-surge air pressures is being considered to move the backfill material to a distance of 300 feet. This concept will attempt to break the stationary plug of deposited fly ash at suitable intervals and move it farther away.

The minimum pressure required to break a stationary plug of fly ash with a pulse of air was measured in an experimental apparatus by the University of Pittsburgh, Pittsburgh, Pennsylvania. Plugs of various lengths were prepared in 6.5 inch ID clear acrylic tubing. The plugs were subjected to bursts of pressurized air. Particles in the upper portion of the plug were displaced in a repeatable pattern. The downstream side of the plugs were severely fractured. A linear relationship was found to exist between plug length and break pressure. A pressure of approximately 0.5 psi/ft was required to break the plugs. At pressures ten to twenty times higher than the minimum pressure, the entire upper portion of the plug was sheared off. The remaining bottom portion of the plug formed into a wavy pattern.

Current work is being carried out to acquire data on pressure drop and mass flow rate in a two-inch conveying line. This should help in designing a conveying system into the mine. Throw distance calculations were carried out to determine how far the fly ash would travel in the mine. It was found that if the particles could be kept from agglomerating, the fly ash could carry up to 270 feet. That information coupled with the pressure drop and mass flow rate data should give some insight into actual conveyance in the mine itself.

Finally, friction factors are being measured so that the experimental data concerning plug breakage can be compared with a theoretical model in the hopes that plug breakage could be predicted in the mine after

The throw distance calculations suggest that to maximize throw distance, the particle agglomeration must be kept to a minimum and the volumetric flow rate of air should be as high as possible. The velocity of the air going into the mine should not have much of an effect due to the large expansion area. Therefore, compressed air may not be the best solution if blowers can produce high standard volumes of air. The proposed pneumatic placement system for backfilling at 100 tons per hour is shown in figure 1.

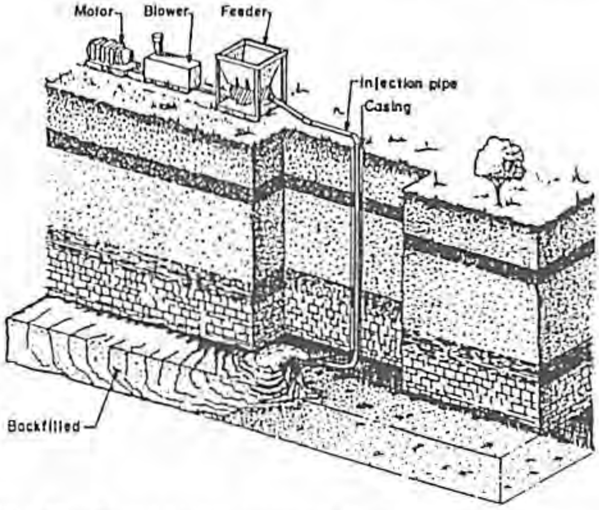

Figure 1. Idealized pneumatic stowing process.

Hydraulic Placement System

A layout of the hydraulic placement system is shown in figure 2. It is being developed in cooperation with Mine System Design, Inc., of Boise, Idaho. This system will have the capability to backfill at a rate of 50 tons per hour.

Pneumatic and hydraulic placement systems will be demonstrated on the surface in Phase II and finally in underground mine workings of Peabody No. 10 mine by placement of 10,000 tons of backfill materials. The demonstration areas are shown in figure 3. Pneumatic placement will be demonstrated in panel entries while the hydraulic placement will be used to backfill a set of rooms (600 ft by 700 ft) with a single borehole.

Presently, efforts are underway to purchase or lease equipment shown in figures 1 and 2 for demonstration in Phase II.

Slump Characteristics of Mixes: The pumping characteristics of hydraulic mixes were determined through ASTM slump tests. The water contents in the mixtures of fly ash, scrubber sludge and lime waste were varied. Two test cones, standard and half of the standard size, were utilized. The half standard size was utilized to reduce the amount of material for the test.

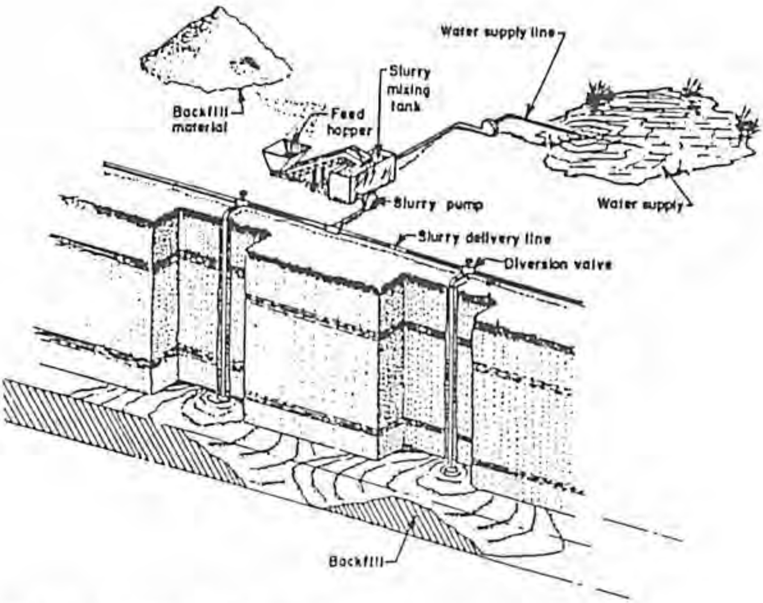

Figure 2. Hydraulic backfilling.

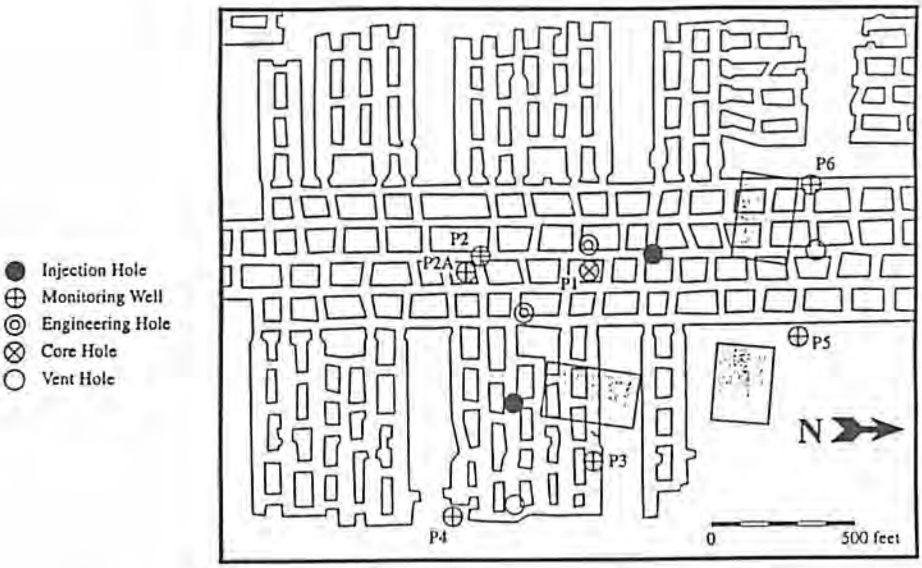

Figure 3. Map of placement near and location of injection and other wells.

The mixtures tested include the following combinations:

(1) 40 percent fly ash, 55 percent scrubber sludge, 5 percent lime waste, 28 percent water;

(2) 40 percent fly ash, 55 percent scrubber sludge, 5 percent lime waste, 28.5 percent water;

(3) 40 percent fly ash, 55 percent scrubber sludge, 5 percent lime waste, 29 percent water; and

(4) 40 percent fly ash, 55 percent scrubber sludge, 5 percent lime waste, 30 percent water.

The slump values for mixes vary between 2.5 and 4.75 inches (standard size cone). Furthermore, the relationship between the slump heights obtained by the standard cone and those by the small cone indicates that the slump height of the small cone is approximately half of that of the standard cone. Thus, the small size cone can be effectively used for estimating standard ASTM slump values.

MATERIALS HANDLING AND TRANSPORT

Overview

The objectives of the materials handling research are to identify the systems that are technically, economically and environmentally feasible in handling and transporting the coal combustion by-products from the power plant to the injection site and to demonstrate the operation of one or two of the identified systems. Engineering economics studies provide economic analyses of the selected materials handling and underground residue placement systems. They will also produce a generalized "Economic Evaluation" model that can be used in evaluating various types of materials handling and placement systems for different distances and tonnages.

During the progra, several handling and transportation systems were evaluated; among these three were found to be technically feasible and environmentally acceptable: pneumatic trucks (PT), pressure differential rail cars (PD-car) and collapsible intermodal containers (CIC)

Engineering and economic analyses for these systems have been conducted. Operating scenarios have been revised after visiting existing operations, meeting with several equipment manufacturers and deliberating with research partners. The developed economic evaluation program is based on the principle of "Net Cash Cost" analysis which is also known as "After-Tax Cost" analysis. This program provides the net present cost of the system, annual equivalent cost, after-tax cost-per-ton and before-tax price-per-ton to be charged to make the minimum required rate of return on investment.

The three systems mentioned above were economically evaluated using the spreadsheets developed for that purpose and the after-tax cost analysis program (fig. 4).

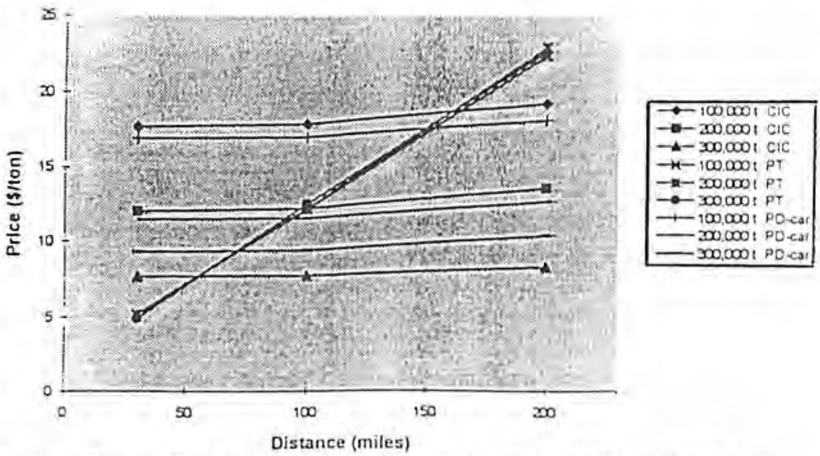

Figure 4. Prices for transporting residues by PTs, CICs, and PD cars.

During the evaluation, it was realized that the system's components are serially connected and that a decision on the size of a component (or capacity), or the number of units within a component, will effect the size of other components or the number of units within the other components. The relationships among the components are not as simple as they appear. Therefore, simulation modeling of the system is being performed to develop optimal systems.

Field Demonstration of Collapsible Intermodal Containers (CICs)

As designed, the CIC is a portable and collapsible storage bin that allows bulk commodities to be moved from place to place and between different types of vehicles by handling the container, not the contents. The CIC is specifically configured to ride in empty coal rail cars. The CIC is about ten feet high, about nine feet in diameter and is constructed of an ultra-violet resistant rubber compound bonded to a fabric comprised of nylon interwoven with kevlar (fig. 5). Each CIC will hold about twenty tons of CCBs.

Figure 5. Collapsible intermodal container (CIC).

The overall concept of the CIC system is that CCB generated at a coal-burning electric power plant could be loaded into CICs, then "back-hauled" to the coal mine by the coal unit train for further utilization or disposal. Empty, collapsed CICs could be taken to the power plant either by truck or on one or two cars hooked to the unit coal train.

On November 17, 1994, a field test of the CIC concept was performed at the Baldwin Power Station of the Illinois Power Company. Three CICs were filled with fly ash. Filling the CICs proceeded without difficulty, with a filling rate of approximately two tons per minute. After being filled, the CICs were transported by a flat-bed truck to a rail siding. The CICs were lifted from the steel loading framework and placed in a hopper car. Loading was without undue difficulty, even though a boom crane, not specifically designed for such use, was used. In fact, the loading of the final (third) filled CIC took only about five minutes.

The rail car containing the CICs was sent on a cross-country journey to Norflok, Virginia. An overhead gantry crane and an articulating gantry crane (which performs ship-to-shore container transfers) were used to move one CIC out of, and back into, the rail car. No problems were encountered in these activities. After the Norfolk tests, the three CICs were returned, still fully loaded, to the Baldwin Power Station. The truck transported the CICs to the Peabody Coal Company coal cleaning plant, a distance of about five miles from the Baldwin station.

The final test was the emptying of the CICs at the Peabody plant; here, difficulties were encountered. The CICs had totally protected the fly ash load from weather (the fly ash was almost exactly as it had been when loaded, i.e., dry), but a specially-constructed inverting frame failed to work properly when attempting to empty the CICs by inverting them. Only two of the three CICs were emptied by the inverting method.

The third CIC was emptied about one month later, using commercial vacuuming equipment. This method of emptying proved successful, as the commercial vacuum system had no problems in removing the fly ash from the CIC efficiently and in a timely manner.

The field demonstration showed that further engineering and design work need to be done on the CICs, particularly to develop a more efficient and effective emptying system. SEEC, Inc. is continuing the development of the CICs and the overall concept of bulk commodity handling and transportation.

ENVIRONMENTAL ASSESSMENT AND MONITORING

The disposal of CCBs near the surface in landfills threatens ground-water resources in many geologic environments. Hydraulic or pneumatic injection of these by-products into deep underground mines offers distinct environmental advantages. First, many underground mines remain dry years after they are sealed (Cartwright and Hunt, 1981). The absence or slow recovery of saturated conditions would minimize leachate production from the by-products. Second, deep mines are located generally below potable groundwater resources where the units bounding the mine contain native brine of no economic value. Third, the CCBs have chemical characteristics which may actually ameliorate an environmental problem associated with high sulfur coal extraction, acid mine drainage. Fourth, the by-products harden like cement when wetted, which could help prevent subsidence associated with underground mining.

At first, it may seem that disposal into abandoned mines should not create any environmental impacts that do not already exist as a consequence of mining. In effect, the by-products are returned to their original environment; however, combustion has altered their physical and chemical properties. Leachate generated by the by-products is distinctly different from that generated by the coal and its bounding strata.

Study objectives are developed to answer two questions: 1) do the increased hydraulic pressures associated with injection induce hydraulic gradients capable of driving native brine or leachate from the by-products into units containing potable resources and 2) as saturated conditions return, can the natural hydrologic properties of the bounding strata contain the leachate? Work completed to date includes: 1) continued refinement of the conceptual model of geologic and hydrologic conditions at the mine; 2) detailed description of packer tests and data analysis methods; 3) development of the programs for controlling the automated data loggers on the site; 4) collection, description and interpretation of a continuous core collected from top of bedrock to the unit below the mined coal; 5) completion of packer tests in the boreholes drilled for the installation of monitoring wells, and 6) installation of twelve monitoring wells, five designed for groundwater chemistry and seven designed to provide data on water levels.

The conceptual model is based on the well log data base of the Peabody No.10 mine and an analysis of well logs on file with the Illinois State Geological Survey (ISGS), as well as a review of the literature on the geology and hydrology of the area around the mine. Individuals working in the area of environmental assessment visited the mine prior to its closure in August 1994, to examine surface workings and underground conditions in one of the target areas.

The ultimate goal of developing a conceptual model is to locate any artificial or natural pathways capable of transmitting contaminants originating from the CCBs to potable groundwater supplies. Possible pathways include permeable units, fractures, fault zones and artificial pathways such as improperly sealed boreholes. The developing conceptual model was used to design the groundwater monitoring program and to determine potential impacts from surface activities such as temporary storage of the by-products. Ultimately, the conceptual model will include the following components: hydrostratigraphy, groundwater flow system, hydrologic boundaries, hydraulic conductivity of the bounding strata, fluid sources and sinks and potential interactions between the flow system near the target panel and other local flow systems.

The areas targeted for disposal are at depths between 325 and 375 feet, well below potable groundwater resources. Selkregg and Kempton (1958) reported that groundwater generally is too mineralized at depths in excess of 200 to 250 feet in Sangamon and Christian Counties to serve as a domestic supply. The rock between the maximum depth of potable water and the mine is mainly shale, characterized by low hydraulic conductivity. Even though potable water may occur in the shallow Pennsylvanian sandstone, most groundwater wells are finished in the sand and gravel horizons within the surficial deposits.

Packer Tests: ISGS and SIUC investigators designed and fabricated a hydraulic injection system for the packer tests. This injection system performed well in the field and was capable of maintaining constant pressures up to 85 psi above the top of the injection pump. Apparently, the bulk hydraulic conductivity of the Pennsylvanian strata overlying the mine is less than 1×10^{-8} cm/sec. In some boreholes, values of hydraulic conductivity were below the intrinsic accuracy of the injection system.

Monitoring Well Installation: The original test plan submitted to the DOE was modified with regard to the location and installation of groundwater monitoring wells. It was suggested that a monitoring well screened in the coal would not yield samples. Although this might be true, the collapse of strata above the Anvil Rock sandstone, the unit nearest the coal with sufficient permeability to yield samples, prevented installation of a screen in the Anvil Rock sandstone in most boreholes. A proactive course of action was taken; installing screens in the more permeable lithologies in the section, up to a maximum of three screens per borehole. For consistency, a screen was set within the coal in all boreholes which pierced the coal.

The number of monitoring wells for sampling was reduced from six, as proposed, to five. The hydraulic and pneumatic injection sites are located near each other (fig. 3), and can share one of the monitoring wells. Most of the boreholes drilled contain a nest of wells (up to three) screened at different horizons in order to assess vertical hydraulic gradients. Having nested wells also departs from the original plan, but will provide data on vertical components of flow and the opportunity to test more than one interval in a borehole with single well test methods. The wells were installed in a pattern that assures at least one well will be up-gradient and one well down-gradient of groundwater flow.

The proposed study area has a favorable geologic and hydrologic setting for the disposal of CCBs. The target panels avoid complex geologic features in the region. Bounding strata have a low intrinsic permeability, and, at present, the target panels are dry. Natural and artificial pathways such as abandoned boreholes, air shafts, faults and fracture zones may transmit groundwater to the mine, but no significant discharge was found within the target panels. The nearest potable groundwater supplies occur at depths less than 250 feet. Most individual users obtain water from the shallow sand and gravel deposits within the unconsolidated surficial materials near the surface.

Underground Conditions: Observations by a borehole camera in the pneumatic injection hole indicate dry borehole walls. The hydraulic injection hole indicates seepage of water from the sandstone unit 15 to 30 feet above the roof line. The heights of the openings in both panels are approximately 6.75 feet. The pillars in the pneumatic panel do not show any sign of spalling, and the old timber posts are relatively intact. The immediate roof of the pneumatic panel is limestone. The pillars in the hydraulic panel show signs of spalling, and the old timber posts are buckled. The immediate roof of the hydraulic panel is 2.5 feet thick shale. A six-inch separation exists between the shale and the overlying limestone. Openings in both panels are in good condition.

Oxygen in the air coming through the boreholes from the panels was three percent, indicating high content of methane. Methane in the underground air cannot be measured because of the low oxygen content in the air. No carbon monoxide in the underground air is detected. A complete analysis of underground air quality is planned for the future.

Subsidence Monuments and Subsurface Instrumentation: Sixty subsidence monuments have been installed over the pneumatic and hydraulic injection panels. The grid consists of subsidence-monument lines in the transverse and longitudinal directions over the panels. Also, four subsidence-monument lines at angles to the longitudinal directions of the two panels were installed. This grid would provide enough surface movement data for developing contours of vertical surface movements over the two panels prior to and after the backfilling. The surface monuments were spaced at 25-foot intervals in the longitudinal and transverse directions. The subsidence-monument-lines extend at least 100 feet beyond the panel edges.

CONCLUDING REMARKS

This program has a large number of cooperating organizations, and the cooperation among all organizations has been exceptional to date. The program is progressing smoothly and is pretty much on schedule. The researchers are looking forward to initiating Phase II on April 1, 1996. The industry and the regulatory agencies are looking forward to the results because successful development and demonstration of the technologies of this program have far-reaching implications for the Illinois Basin coal industry.

ACKNOWLEDGEMENTS

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Mr. Wayne Bahr, Manager, Research and Development, Office of Coal Development and Marketing
Mr. Matt Haaga, Peabody Coal Company
Mr. Douglas Downing (representing Illinois Coal Association)
Mr. Ronald Morse, Illinois Environmental Protection Agency
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REFERENCES

Chugh, Y.P., D. DuttaDuet, S. Esling, B. Paul, H. Sevim, E. Thomasson, X. Yuan,1995, Management of Dry Flue Gas Desulfurization By-Products in Underground Mines, Annual Technical Program Report, October 1, 1994 - September 30, 1995. Submitted to the U.S. Department of Energy, Cooperative Agreement No. DE-FC21-93 MC-30252.

Cartwright, Keros and C. S. Hunt, 1981, Hydrogeologic Aspects of Coal Mining in Illinois: An Overview, Illinois State Geological Survey, Environmental Note 90, 19 p.

Selkregg, L.F., and J.P. Kempton, 1958, Groundwater Geology in East Central Illinois. Illinois State Geological Survey, Circular 248, 36 p.

Robert Kudlawiec: Thank you, Dr. Chugh, for your fine presentation. Our next speaker is Mr. Norbert Paas, who will talk about the experience with a prototype DRY SYSTEM™ scrubber at the Cyprus AMAX Wabash Mine.

Norbert is president of Paas Technologies, and designer of the DRY SYSTEM™ technology. Norbert has a mechanical engineering degree from Germany; he has over 20 years of mining experience, from working in an underground diesel workshop, to doing engine research at Southwest Research. For the last 12 years, Norbert has been working as an independent designer of the DRY SYSTEM™ technology. Prior to that, he had experience with diesel engines. So without further ado, Mr. Norbert Paas.

Norbert Paas: Thanks, Bob.

EXPERIENCE WITH A PROTOTYPE DRY SYSTEM™ AT THE CYPRUS AMAX WABASH MINE, ILLINOIS, UNITED STATES

NORBERT PAAS
Paas Technologies, Inc.
Louisville, Colorado

INTRODUCTION

A prototype DST DRY SYSTEM™ was placed about a year ago at the Cyprus AMAX Wabash Mine. The system is the first MSHA certified system of its kind and was retrofitted to a Jeffrey ramcar.

Dry Systems Technologies is a Partnership of four companies. Cyprus AMAX is one of the partners. Goodman Equipment Corporation and Brookville Mining Equipment Corporation are the two manufacturing partners. Paas Technologies is performing the engineering and development.

Before discussing specifics, a few historical facts about the use of diesel equipment in underground coal mines should be of interest. Not too long ago, perhaps about ten years back, diesel equipment was first introduced to underground coal mines in southern Illinois. However, diesel engines in coal mines are not new; they have been used for at least 35 years. In the U.S., diesel-powered equipment has been around in our coal mines for over 25 years in underground coal mines (fig. 1). In 1974, there were about 90 machines in use, most in the western U.S. In the eighties, more diesels were introduced in the East, mostly in Kentucky and Maryland. Then in the mid eighties, diesel units were put into Illinois mines. By the end of 1995, the number of diesel engines will have increased to about 3,000.

Diesel equipment has several advantages over equipment with trolley wires, trailing cables and batteries: power, safety, and productivity.

A disadvantage of diesel equipment is the need for regular maintenance. While this maintenance is not extensive, the lack of it can have significant consequences on engine performance and emissions.

Presently, Cyprus AMAX and Paas Technologies are establishing an advanced Emissions Management Program™ (fig. 2). The program consists of three elements: establishing low baseline emissions, maintaining low emissions and verifying emission levels.

The first element is to establish low baseline emissions by selecting only clean, certified diesel engines, by placing tight control on the diesel fuel supply and by specifying machine and after-treatment features that further reduce the emissions levels. We are starting out with today's best available technology.

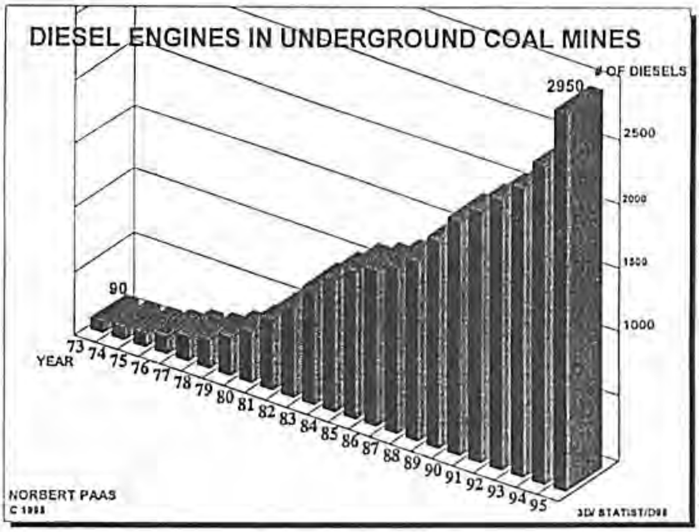
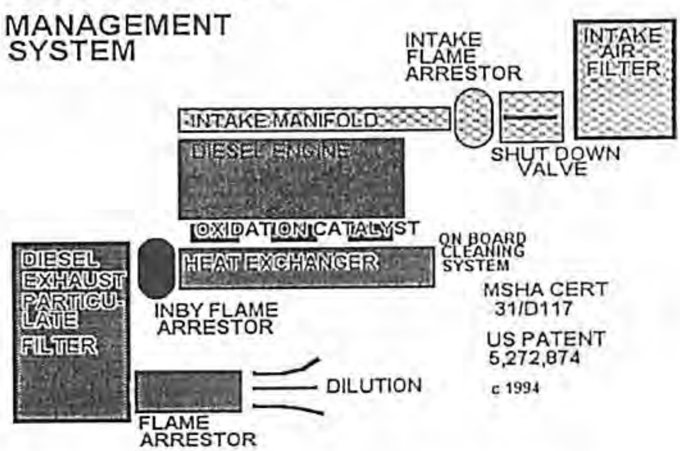


Figure 1. Number of diesel engines in underground coal mines of the United States, 1973 to 1995.



The DST MANAGEMENT SYSTEM™ consists of the following main components, arranged as a tuned system, to provide the optimum diesel emissions reduction and provide the highest level of safety:

MSHA certified pre-combustion chamber diesel engine
Water jacketed oxidation catalyst
Tube and shell heat exchanger
Crimped ribbon inby flame arrestor
Low temperature disposable diesel particulate filter
Exhaust flame arrestor
Final dilution device
On board cleaning system
Exhaust gas temperature sensor at filter inlet

Coolant temperature sensor
Exhaust gas backpressure sensor
Engine shut down system

Intake manifold
Intake flame arrestor
Intake air shut down valve
Intake air cleaner
Intake restriction indicator

Figure 2. DST DRY SYSTEM™ Emissions Management Program.

The second element is maintenance. The key to maintenance, of course, is training of the mechanic and the operator. The operator must understand the function of the equipment. Diagnostic feedback gauges aid the operator in detecting potential problems. The same gauges will help the mechanic to diagnose problems and initiate the right corrective actions.

The third element is to verify that low emission levels are actually maintained. The DRY SYSTEM™ is fitted with sampling ports to monitor untreated tailpipe emissions.

DST DRY SYSTEM™AS PART OF THE OVERALL PROGRAM

The five basic areas of the Cyprus AMAX program are:

- Diesel fuel quality;
- Mechanical features;
- Diesel maintenance;
- Equipment operation; and
- Emissions sampling.

The DST DRY SYSTEM™ is part of the the mechanical features and covers two areas: permissibility and emissions reduction.

A DST DRY SYSTEM™ package is an MSHA Part 36 certified package that meets all requirements for operating inby. In addition, it provides significant reductions in emissions, discussed later.

Figure 3 shows a Jeffrey ramcar indicating the DST system exhaust particulate filter mounted on the front, and figure 4 is a view of the open engine compartment of the ramcar showing DST system components.

The DST DRY SYSTEM™ was originally conceived as a replacement for the water scrubber. The disadvantages of the water scrubber—high water consumption, sensors with poor reliability—are well known to operators of machines equipped with water scrubbers. Of course, a water scrubber is not an effective device to reduce emissions. The DST system utilizes a clean, low emissions engine. A manifold catalyst reduces or "burns up," the unburned hydrocarbons; these are primarily unburned fuel and engine oil. These constituents are responsible for the typical "diesel smell," which is eliminated. Since the unburned hydrocarbons attach themselves to the carbon-based diesel particulates, their elimination reduces total particulates emission by up to 30 percent.

Another important component is the heat exchanger. There, the exhaust gases are rapidly quenched, resulting in cooled exhaust gases which are discharged at a safe temperature level. Another benefit is the apparent agglomeration of the sub-micron particles into larger, easier to capture particulates. A mechanical flame arrestor is installed between the heat exchanger and the filter housing.

The particulate filter is disposable; it is made of inexpensive material, yet has a capturing efficiency of 98 percent

Before discharge of the treated exhaust gases, which are mixed with the air from the radiator, another flame arrestor is used. The intake system also includes a flame arrestor and a safety shut-down valve, which are required by MSHA.

Figure 3. Jeffrey ramcar showing exhaust particulate filter of DST DRY SYSTEM™.

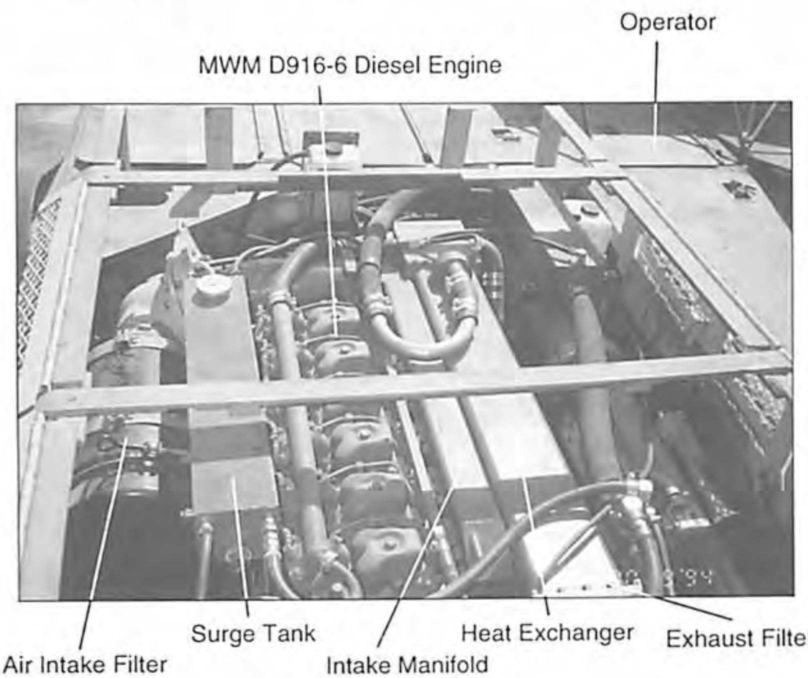


Figure 4. Components of DST DRY SYSTEM™ installed on engine of Jeffrey ramcar.

The DST DRY SYSTEM™ has received MSHA Part 36 certifications for two different configurations (31/D117 and 31/D119). The complete system, as well as individual features, are patented or have patents pending in the U.S. and foreign countries.

The DST system replaces the water scrubber; the following table compares key design and performance features for both systems.

Table 1. Comparison of key design and performance features for water scrubber and DST DRY SYSTEM™.

	MSHA Part 36 Requirement	Water Scrubber	DST DRY SYSTEM™
1	Maximum surface temperature of less than 302°F for all components	Yes	Yes
2	Maximum exhaust gas temperature at discharge	<170°F	<302°F Undiluted <170°F Diluted
3	Exhaust flame arrestor	Yes (Water box)	Yes (Mechanical)
4	Water level sensor	Yes	Not Needed
5	MSHA certified flange connections	Yes	Yes
6	Exhaust spark arrestor	Yes(Water box)	Yes (Mechanical)
7	High coolant temperature sensor	Yes	Yes
8	High exhaust temperature sensor	Yes	Yes
9	Components withstand explosion pressure	Yes	Yes
10	Intake flame arrestor	Yes	Yes
11	Intake air shut-off valve	Yes	Yes
12	MSHA certified engine	Yes	Yes
13	Minimum ventilation requirement (MWM)	8700 CFM	8700 CFM
	Other Features		
14	Carbon monoxide reduction	None	50-95%
15	Hydrocarbon reduction	<10%	50-95%
16	Diesel particulate reduction	<10%	>95%
17	Water vapor in exhaust	Yes	No
18	Corrosion of exhaust system	Yes	No
19	Daily flushing	Yes	Not required
20	Water consumption	>100 gal/day	None
21	Depletion of cooling water	Yes	No
22	Daily exhaust system maintenance	20-60 minutes	<10 minutes
23	Unscheduled system shut-down	Frequent	None
24	Sensor reliability	Low	High
25	Odor	Detectable	Not detectable
26	Sulfur release	Sulfuric acid	Gaseous
27	Scrubber water disposal	Dumped	Not required
28	Filter safe to dispose under EPA rules	?	Yes
29	Filter fire hazard		None

Results of Emission Tests

We conducted an emission test series at West Virginia University in Morgantown. Table 2 summarizes the results of these tests. Diesel particulates were reduced by 98 percent and above. These tests were conducted under transient loads and steady state, both practices that are typically applied in EPA type emission testing. The first test series was without a catalyst; the second series included the manifold catalysts.

What does this mean to the mine operator with diesel equipment? This can be explored with a hypothetical installation:

- A 100 HP diesel engine is operating in a drift with 11,500 CFM of ventilation air. (No ventilation except the minimum air for the engine, only as a comparison).

- We assume the engine produces 160 SCFM of exhaust gases which contain 140 to 180 mg/m^3 diesel particulates.

At a 70:1 mixing ratio, the ambient concentrations of the diesel particulate matter for a current system without a filter would be about 2.5 mg/m^3.

For the DST DRY SYSTEM™, the treated, undiluted exhaust at the tailpipe is 160 SCFM exhaust gas containing 2.6 to 2.8 mg/m^3 diesel particulate matter. At the same 70:1 mixing ratio, the ambient concentrations of particulate matter would be 0.04 to 0.05 mg/m^3 (fig. 5).

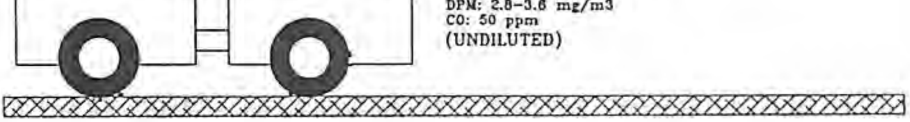


Figure 5. Treated and diluted exhaust gas from a 100 HP diesel engine.

Although there are no current standards for diesel particulates, the ambient (total) dust standard, which includes diesel particulates, is 2 mg/m^3. Limits ranging from 0.15 to 0.6 mg/m^3 have been suggested by various organizations. Without endorsing any of these suggested limits, we can plainly state that we will meet any of these levels with the DST DRY SYSTEM™.

Table 2. Results from emissions testing at West Virginia University.

CATALYZED

	BoM 1	ISO 1	ISO 2	ISO 3	ISO 4	ISO 5	ISO 6	ISO 7	ISO 8
LOAD	Varies	100%	75%	50%	10%	100%	75%	50%	10%
SPEED	Varies	2100	2100	2100	2100	1500	1500	1500	1500
DPM	-98.9%	-98.5%	-98.0%	-98.5%	-98.1%	-99.0%	-98.8%	-98.9%	-97.7%
HC	-96.9%	-44.4%	-57.1%	-71.1%	-40.6%	-54.6%	-61.9%	-45.5%	-52.1%
CO	-59.2%	-60.9%	-59.1%	-55.6%	-38.1%	-62.3%	-60.1%	-45.5%	-17.4%
CO_2	-1.0%	+2.3%	+3.6%	-0.1%	+1.1%	+1.9%	+1.6%	+2.3%	+5.7%
NO_x	+1.9%	+1.5%	+3.9%	+1.0%	+2.8%	+9.0%	+3.0%	+3.8%	+11.9%

WITHOUT CATALYSTS

	BoM 1	ISO 1	ISO 2	ISO 3	ISO 4	ISO 5	ISO 6	ISO 7	ISO 8
NO. OF TESTS	4	3	3	3	3	3	3	3	3
LOAD	Varies	100%	75%	50%	10%	100%	75%	50%	10%
SPEED	Varies	2100	2100	2100	2100	1500	1500	1500	1500
DPM	-98.6%	-96.7%	-97.3%	-97.5%	-97.5%	-97.5%	-97.6%	-98.5%	-97.4%
HC	-34.4%	-18.5%	-38.6%	-10.5%	-29.7%	-18.2%	-14.3%	-3.0%	-3.0%
CO	-10.8%	-5.8%	-7.4%	-0.4%	-8.8%	-19.5%	-9.9	-6.9%	-9.3%
CO_2	-0.9%	+1.4%	+0.3%	+0.3%	+2.3%	+1.4%	+1.0	+1.4%	+7.4%
NO_x	+0.1%	+0.1%	-7.4%	+3.1%	+6.6%	+4.7%	-3.9%	-2.7%	+9.7%

In addition to the machine at the Wabash mine, we have retrofitted five other machines: three Eimco 975s, one Eimco 913 and one Wagner 25X. All these machines are operating in Cyprus AMAX mines in the western United States. The experience with the Wabash machine, which is the first DST-equipped machine that operates at the face, has been very positive. The machine availability has been better than 98 percent for the year.

The retrofit was not a simple matter because the machine is MSHA approved. We started with a previously approved Jeffrey ramcar and a certified MWM D916-6 diesel engine. Changes were made to the Jeffrey machine and to our certified DST package. This required that we retest our package at MSHA Triadelphia and apply for a field modification to the machine at MSHA Vincennes.

The application for certification of the DST package was submitted on July 20, 1994, and the laboratory testing at Triadelphia was performed in September 1994. The DST package was fabricated and assembled at the Goodman plant in Chicago in June and July 1994. The installation into the ramcar and modifications to the ramcar were performed by Jeffrey's Norris City rebuild center in September and October 1994. The MSHA field inspection at Norris City was performed in November 1994, and we received the new DST package certification and the new machine approval on December 9, 1994. Engineering, certification work and project management were by Paas Technologies. Because of the excellent team work between the mine, the manufacturers and MSHA, this complex certification and approval of a prototype was completed in record time.

The machine went underground in December 1994 and was placed into production in January 1995. Some debugging was required during the first two months of operation. Also, an extensive training program was conducted for the machine operators and mechanics.

At the time of this presentation, the machine had completed over 2,000 operating hours. The average availability has been 98.8 percent, 100 percent in the past four months. Filter life averaged 18 to 20 hours. The machine had the highest production rate out of four cars in the section. There have never been any problems with overheating of the cooling system. There have not been any unscheduled shut-downs. No hazardous or unsafe operating conditions have been observed. Finally, there were never any conditions that could have led to a filter fire.

Dry System Technologies is currently completing work on the MSHA certification of a Caterpillar 3306 engine rated at 150 HP. Other engine packages we have planned include the Isuzu C240 at 57 HP, the Caterpillar 3304 at 100 HP and the Lister-Petter LPU 4 at 37 HP.

Robert Kudlawiec: Are there any questions?

Norbert Paas: I have a few brochures I will lay out if anybody wants to pick them up.

Question: What do you do with the old filters when they have been used. Do you recycle them?

Norbert Paas: The old filters get disposed of either through landfill or incineration. They can be crushed and put in a gob or, since it is all carbon that we are collecting, you can sell them to power companies.

Robert Kudlawiec: Thank you Norbert. Our next speaker is Mr. Mike Shackleford, Manager of Coal Preparation and Quality at the Wabash Mine. Mike holds a degree in mining technology from the University of Southern Florida and also a degree in management from Wesleyan College. Mike has approximately 30 years in the mining industry; ten years in the phosphate mines of Florida and 20 years in the coal industry. Without further hesitation, Mr. Mike Shackleford.

Michael Shackleford: Good morning, I am very happy to be here today.

FINE COAL RECOVERY AT THE WABASH MINE–CIRCUIT MODIFICATIONS AND ADDITIONS

MICHAEL SHACKLEFORD

Wabash Mine, Cyprus AMAX Coal Company
Keensburg, Illinois

INTRODUCTION

During the summer of 1993, Cyprus AMAX Coal Company commissioned a recently completed 1,500 tons per hour (tph) preparation plant at the Wabash Mine near Keensburg, Illinois. Completion and operation of this new plant allow the washing of Wabash Mine's total coal production. From 1984 to mid 1993, a smaller 250 tph heavy media coarse coal wash plant was used. The new plant allows the mine to assist its primary utility customer to meet air quality emission limitations for their electric power generating facility.

The basic conceptual flowsheet of the new plant accepts four inch by zero feed material. An initial screening operation separates at one-half inch. The oversize material is washed in Daniels heavy media vessels with downstream sizing and centrifugal drying. After a desliming stage, a portion of the minus one-half inch material can be removed and bypassed directly to the product collecting conveyor.

The minus one-half inch material is then deslimed at one millimeter (mm) before further processing. The one-half inch by one mm is washed in a heavy media cyclone circuit while the one mm by zero fraction is pumped to the fine coal circuit (fig. 1).

FINE COAL CIRCUIT

The fine coal circuit consists primarily of classifying cyclones (not shown in fig. 1) followed by spiral separators. Screening and dewatering steps complete the circuit. All the various products are collected on the product collecting conveyor and transferred to the product storage silos. When the data of the initial testing of plant performance for acceptance were evaluated and subsequent data of routine plant operation analyzed, the potential for improving the coal recovery in the fine coal circuit and for maximizing the efficiency of the new plant was recognized. Plant modifications and additions were proposed to meet the following objectives:

- Recover fine coal in the 65 mesh by 130 mesh size fraction;
- Reduce screen wear;
- Reduce the amount of water sent to the screen bowl centrifuges;
- Improve the percent solids in the screen bowl centrifuge feed; and
- Reduce the chemical costs of the operation.

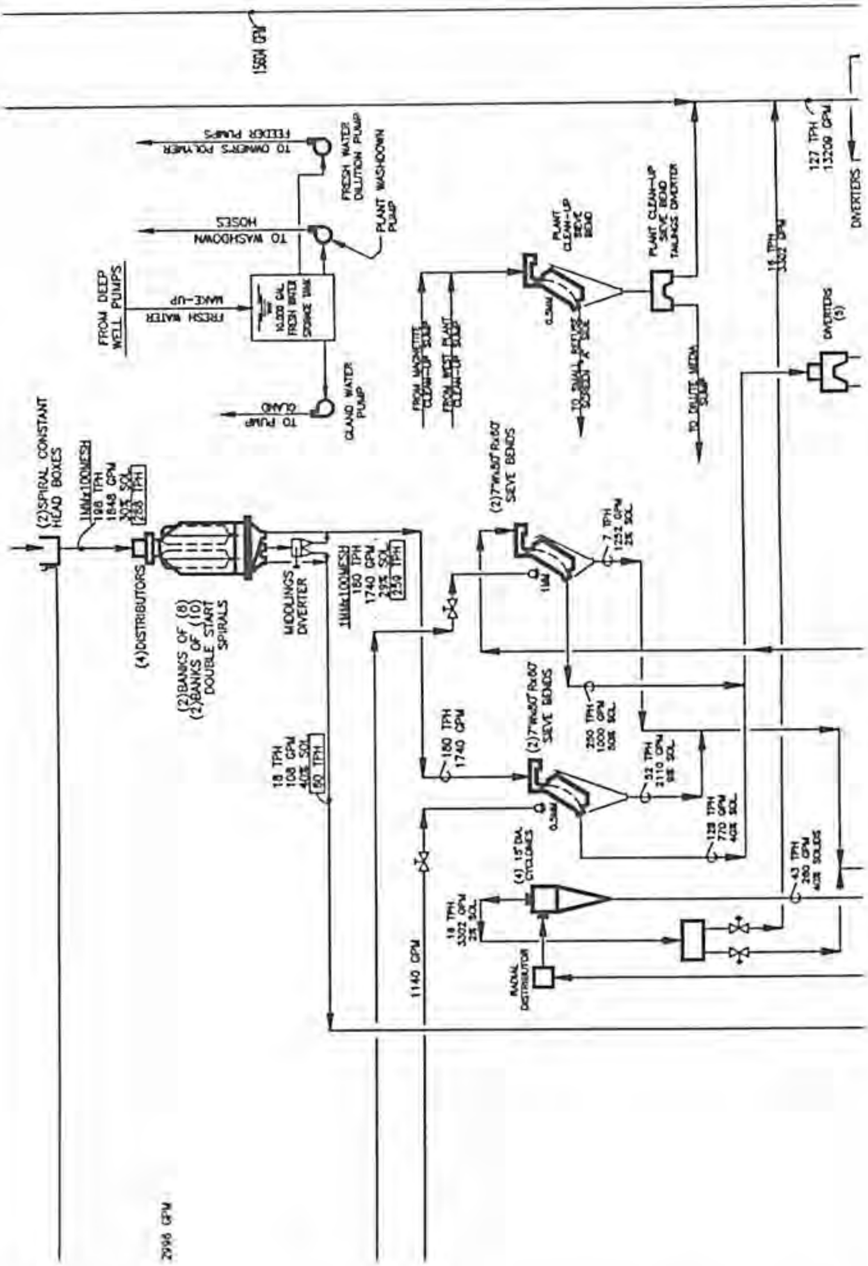
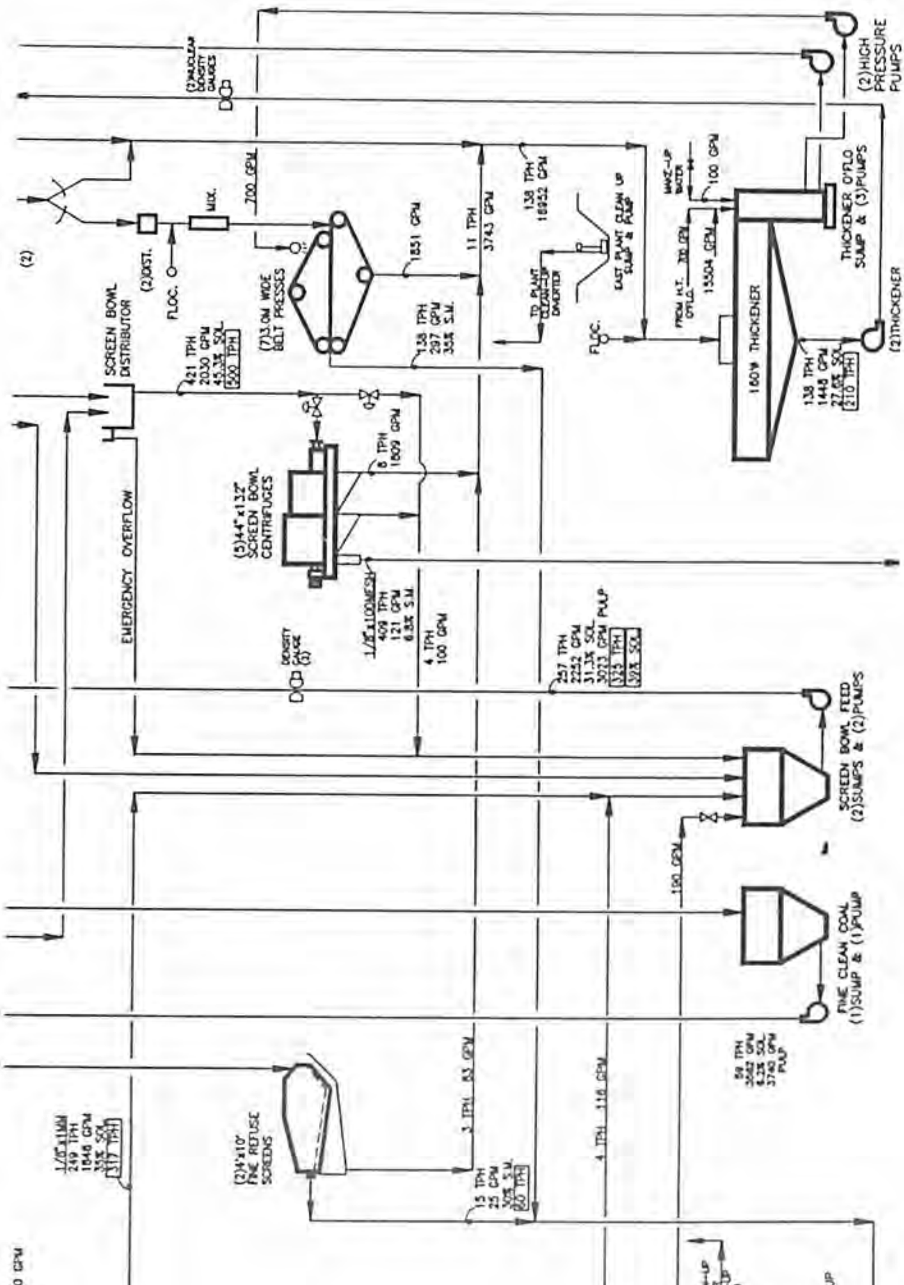


Figure 1. Fine coal circuit of preparation plant at Wabash Mine after modifications.


(2)HIGH PRESSURE PUMPS
THICKENER O'FLO SUMP & (3)PUMPS
(2)THICKENER
160'Ø THICKENER
138 TPH 1448 GPM 27.6% SOL
210 TPH
FLOC.
MAKE-UP WATER
100 GPM
FROM H.T. O'FLO
700 GPM
13504 GPM
EAST PLANT CLEAN UP SUMP & PUMP
TO PLANT CLEAN-UP DAUGHTER
138 TPH 16952 GPM
11 TPH 3743 GPM
1851 GPM
138 TPH 297 GPM 35% S.M.
(7)3.0M WIDE BELT PRESSES
MIX.
700 GPM
(2)DIST.
FLOC.
(2)
SCREEN BOWL DISTRIBUTOR
421 TPH 2030 GPM 45.3% SOL
500 TPH
(5)44"x132" SCREEN BOWL CENTRIFUGES
8 TPH 1809 GPM
1/8"x100MESH 409 TPH 121 GPM 6.8% S.M.
4 TPH 100 GPM
EMERGENCY OVERFLOW
DENSITY GAUGE
257 TPH 2252 GPM 31.3% SOL 3023 GPM PULP
SCREEN BOWL FEED (2)SUMPS & (2)PUMPS
190 GPM
FINE CLEAN COAL (1)SUMP & (1)PUMP
59 TPH 3582 GPM 6.2% SOL 3740 GPM PULP
(2)4'x10' FINE REFUSE SCREENS
1/8"x1MM 249 TPH 1848 GPM 35% SOL
317 TPH
3 TPH 83 GPM
15 TPH 25 GPM 30% S.M.
60 TPH
4 TPH 118 GPM
200 GPM

The proposal was approved based on the anticipated increase of nine tons per hour of product for a typical 14 hours per day operating schedule. It was estimated that less than six months of plant operation would be required to recover the initial investment for the proposed plant modifications and additions from the revenue gain. Reduced costs for screens and chemicals and improved equipment operating efficiencies were expected to enhance payback even further.

The one mm by zero material, the underflow from the desliming screens, is pumped to two banks of ten 14-inch diameter classifying cyclones. The separation is made at 100 mesh with the 100 mesh by 0 overflow sent along with most of the water to the refuse thickener. The one mm by 100 mesh classifying cyclone underflow, at 40 percent solids, goes to the spiral separators. Additional water is drawn from the head tank to dilute the feed to the spiral separators to 30 percent solids (top of fig. 1).

Two banks of eight and two banks of ten double-start spiral separators are used. The refuse from the spiral separators, at approximately 40 percent solids, is dewatered on the fine refuse screen. The spiral separator product is removed at approximately 29 percent solids. Additional push water is added to facilitate the downstream screening steps.

The following list highlights the features of the fine clean coal circuit to this point.

- Feed to circuit (1 mm x 0) to 20 14" diameter classifying cyclones, 309 tph; 11,095 gpm/(10% solids)
    - Classifying cyclone overflow (100 mesh x 0)
      111 tph; 9,907 gpm–to the refuse thickener
    - Classifying cyclone underflow (1 mm x 100 mesh)
      198 tph; 1,188 gpm (40% solids)–feed to spiral separators.
- Feed to 36 double-start spiral separators
  198 tph; 1,188 gpm (40% solids)–from classifying cyclone underflow add 660 gpm–from head tank
  198 tph; 1,848 gpm (30% solids).
    - Spiral separator refuse
      18 tph; 108 gpm (40% solids)–to fine refuse screen.
    - Spiral separator product
      180 tph; 1,740 gpm (29% solids)–to recovery and dewatering equipment.
- Feed to screening and dewatering equipment 180 tph; 1,740 gpm–from the spiral separator product add 1,140 gpm–from head tank
  180 tph; 2,880 gpm.

Downstream from this location in the circuit is where the modifications and additions take place. The following list compares the remaining original circuitry with the modifications and additions.

Table 3. Fine clean coal circuitry–original design and after modifications.

	Original Design	Modified Design
Fine clean coal sieve bends	(4) 7″ W x 80″ separating at 70 m	(2) 7″ W x 80″ separating at 30 m
Fine clean coal sieve bend O/F 770 gpm (40% solids)	150 tph; 900 gpm to (5) centrifuges	128 tph to (3) centrifuges
Fine clean coal sieve bend U/F	30 tph; 1,980 gpm to refuse thickener	52 tph; 2,110 gpm to new fine clean coal sump add 7 tph; 1,252 gpm from new screen bowl centrifuge feed sieve bend U/F; total of 59 tph; 3,362 gpm–feed to (4) new 15″ diameter classifying cyclones separating at 130 mesh
Classifying cyclone U/F		43 tph; 260 gpm (40% solids)–to screen bowl centrifuges
Classifying cyclone O/F		16 tph; 3,102 gpm (2% solids)–to refuse thickener

The original design combined the clean coal product from the spiral separators with the clean coal product from the heavy media cyclone circuit for dewatering in the screen bowl centrifuges. The original fine clean coal sieve bends were designed to classify the spiral separator product at a nominal 100 mesh separation. Natural inefficiency and screen wear allowed some material larger than 100 mesh to pass through the screens and report to the refuse thickener. This misplaced material was incorporated into the refuse and lost as product. The sieve bend screens were manufactured with a relatively thin gauge wire which wears quickly and is approximately twice the cost of heavier wire screen.

The following plant modifications and additions were proposed:

- Install two new fine coal dewatering sieve bends;
- Replace the screens on the existing fine coal sieve bends;
- Install four new 15-inch diameter second classifying cyclones;
- Install a new fine coal sump; and
- Install necessary piping and circuit changes required to integrate the modifications into the original plant circuitry.

These modifications and additions were expected to produce the following results:

- Improve the recovery of fine coal in the 60 mesh by 100 mesh size fraction;
- Capture a portion of the 100 mesh by 130 mesh clean coal originally lost to the refuse;
- Reduce maintenance expenses associated with the replacement of the fine clean coal sieve bend screens;
- Improve the operation of the screen bowl centrifuges by reducing the excess water load subsequently reducing the number of machines required to operate; and
- Reduce the chemical costs of the operation.

The original fine clean coal sieve bend screens were changed to make a separation at 30 mesh. There were four seven-feet wide, 80-inch radius, 60-degree sieve bends. The new screens for these units are 3/32 inch ISO stainless steel with 0.75 mm openings. The overflow from the fine clean coal sieve bends reports to the screen bowl centrifuge feed distributor, as in the original design. The underflow from the fine clean coal sieve bends reports to the new fine coal sump instead of the refuse thickener, as in the original design.

The fine clean coal (one mm by zero) is pumped from the new fine coal sump on level one of the preparation plant to four new 15-inch diameter secondary classifying cyclones located on level four of the plant. The new secondary classifying cyclones are arranged in a single bank of four units and make a classification of 150 mesh. The underflow from these new cyclones reports to the original screen bowl centrifuge feed distributor. The overflow from the new cyclones is collected in two separate hoppers. This arrangement was added to facilitate the operation on a half-plant basis.

As part of the process control, a two-way diverter is located below one of these cyclone overflow hoppers. This allows the overflow from two of the secondary classifying cyclones to be directed to either the refuse thickener feed flume or back to the fine coal sump for recirculation. The discharge from the other overflow hopper reports to the refuse thickener feed flume.

The two screen bowl centrifuge feed pumps originally pumped the three mm by zero clean coal to the overflow hopper of the original fine clean coal sieve bends. The three mm by zero clean coal is now redirected to two new fine clean coal dewatering sieve bends which classify at one mm.

The overflow from the fine clean coal dewatering sieve bends reports to the original screen bowl centrifuge feed distributor. The underflow from these sieve bends reports to the new fine coal sump. A valved line was installed under each fine clean coal dewatering sieve bend to allow underflow to be diverted to the screen bowl centrifuge feed distributor to provide control of the percent solids feeding the screen bowl centrifuges.

The new fine clean coal dewatering sieve bends increase the percent solids of the feed to the centrifuges from 20 to 45 percent. The 45 percent solids feed ratio decreases the number of screen bowl centrifuges required to be operated. This in turn reduces the wear on the units and lowers the power consumption.

RESULTS

The objectives set out in the original proposal for the plant modifications and additions have all been achieved. An additional nine tons per hour, the original financial justification for the project, have been realized. In doing so, the project has been paid for and continues to produce increased realization.

Table 4 compares the material flow of the screen bowl centrifuges as originally designed and after the modifications and additions were completed. The nine tons per hour increase in product is achieved with much less water fed to the screen bowl centrifuges; this allowed a reduction of the number of centrifuges required to operate.

Table 4. Screen bowl centrifuges–original design and after modifications.

	Original Design		After Modifications	
	tph	gpm	tph	gpm
Feed				
Spiral product sieve bend O/F	150	900	128	770
Screen bowl feed sump	257	2,252	250	1,000
Fine clean coal classifying cyclones			43	260
Total	**407**	**3,152**	**421**	**2,030**
Product (6.8% S.M.)	400	117	409	121
Effluent	3	2,935	8	1,809
Feed				
Spiral product sieve bend O/F	150	900	128	770
Re-circulating overflow	4	100	4	100
Net changes due to modifications				
Centrifuge feed			14	-1,122
Centrifuge effluent			5	-1,126
Centrifuge product			9	+4

The reduction in screen wear is realized in the increased period between sieve bend screen changes as well as the reduced cost of the replacement screen panels. This resulted in an overall reduction of approximately \$0.015 per product ton. Chemical costs have decreased approximately \$0.08 per product ton since the installation and start-up of the circuitry modifications and additions. Similarly, power consumption, due primarily to the operation of fewer screen bowl centrifuges, has decreased but has not been quantified at this time.

Table 5 compares the material flow for the refuse thickener as originally designed with that after the completion of the modifications to the fine coal circuit.

Table 5. Refuse thickener–original design and after modifications.

	Original Design		After Modifications	
	tph	gpm	tph	gpm
Feed				
14" Classifying cyclone O/F	111	9,907	111	9,907
Spiral product sieve U/F	30	1,980	-	-
15" Sec. classifying cyclone O/F	-	-	16	3,302
Fine refuse screen	3	83	3	83
Screen bowl effluent	3	2,935	8	1,809
Belt press effluent	-	1,925	-	1,851
Total	147	16,830	138	16,952
Underflow (27.6% solids)	147	1,540	138	1,448
Available for recirculation		15,290		15,504
Head tank overflow		500		500
Make-up water		314		100
Overflow pumped		16,104		16,104

An additional benefit of these circuit modifications has been an increase in the amount of water available for recirculation at the refuse thickener overflow. This has resulted in a corresponding decrease in the demand for makeup water for the plant. The value of this benefit has not been quantified at this time.

Question: What is your overall recovery?

Michael Shackleford: We ended up picking up about one and a half percent overall. Btu recovery also went up. We are at about 94 percent, somewhere in there; so we are doing a pretty good job.

Robert Kudlawiec: Thank you, Mike. Our final speaker is Mr. Joe DeBarr, Associate Chemist with the Illinois State Geological Survey. Joe will talk about high value products from Illinois coal.

Joe has a master's degree in environmental science from the University of Illinois; he has ten years with the ISGS. Joe.

Joseph DeBarr: Thanks, Bob. My talk today is actually a summary of current and fairly recent research efforts at the ISGS.

HIGH-VALUE PRODUCTS FROM ILLINOIS COAL

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INTRODUCTION

The Illinois State Geological Survey (ISGS) has had a research program since 1983 aimed at finding new uses for high-sulfur Illinois coal. Since 1990, one focus of this program has been to use Illinois coal as a precursor for preparing high-value solid products.[1-5] These high-value, carbon-based products include carbon molecular sieves (CMS) for separating multi component gas streams, and activated carbons prepared both for storing methane and for removing contaminants from flue gas streams. In this paper, the status of the ISGS's efforts to develop these high-value products and the resulting potential for increased utilization of Illinois coal are described.

BACKGROUND

Activated carbons, with their large surface area, are used for both liquid- and gas-phase adsorption processes.[6] Of the 350,000 tons of activated carbons produced worldwide annually, 80 percent are used in liquid-phase applications.[6] Activated carbons are produced industrially from several precursors, including wood, peat, lignite, bituminous coal and coconut shells. Production of activated carbons typically involves thermal processing steps that include preoxidation, pyrolysis and activation. Preoxidation in oxygen-containing gases at temperatures less than 300°C reduces or eliminates the swelling and caking tendencies of certain starting materials, such as bituminous coal. Pyrolysis in inert gas removes volatiles from the starting material and develops initial porosity. Large surface areas and a developed pore structure are created during the activation step. The activation step may be done by either chemical or physical methods. For chemical activation, the starting material is mixed with compounds such as potassium hydroxide (KOH) or phosphoric acid (H_3PO_4), and the mixture is pyrolyzed. Physical activation is the more common method for activated carbon production. This involves partial gasification of the post-pyrolysis carbonaceous skeleton by gases such as carbon dioxide or steam at temperatures ranging from 700° to 1,100°C. ISGS researchers have used both chemical and physical activation processes to prepare a wide variety of carbon-based materials tailored for specific applications.

CURRENT RESEARCH EFFORTS

Carbon Molecular Sieves

Gas separation is a major component of production costs for the chemical industry today. Commercial interest in CMS is growing and these materials are currently being used to replace less efficient adsorbents in industrial gas separation processes. CMS are microporous materials having pore dimensions similar to the critical dimensions of the gas molecules to be removed. The pore surface areas of CMS are usually less, and the pore-size distributions narrower than those of commercial activated carbons. The present applications of CMS include the size-separation of gas molecules. Such separations include: oxygen and nitrogen,[7,8] carbon dioxide and methane,[1,9,10] oxygen and argon,[11] hydrogen and coke oven gases,[12] ethylene and ethane, and propylene and propane. Separations with CMS are based on differences in the diffusion rates of the gaseous species, in contrast to those with zeolites, in which the separation efficiencies are based primarily on their chemical affinity for a specific component in the gas mixture. Two gas molecules which differ only slightly in critical dimensions, e.g., 0.2 angstroms, may be adsorbed by CMS at rates that vary by several orders of magnitude. Thus, a small change in the average pore size of a carbon material could significantly affect the rate of diffusion of a gas molecule into the pore structure.

CMS are presently being used at more than 4,500 plants worldwide to separate the components of air, and produce nitrogen.[13] The development of CMS tailored to adsorb a particular gas could also lead to a wide range of new process applications, e.g., air pollution control, catalyst supports, and gas separation membranes. Currently, no U.S. company manufactures CMS on a commercial scale. The production of CMS on a tonnage scale needs to be economically competitive with respect to overseas technology. The current market price of CMS ranges between $5,000 and $10,000/ton, depending on the application and the production scheme. This is significantly more than the price of granular activated carbon, which now costs between $1,000 and $2,000/ton.

Under controlled conditions of heat treatment and activation, it has been possible to prepare, from coal, adsorbents which have a relatively narrow pore-size distribution and which exhibit molecular sieving behavior.[11,14-16] At the ISGS, CMS that have commercially significant surface areas of 1,500-2,100 m^2/g and more than twice the adsorption capacity of commercial carbons and zeolite molecular sieves were prepared from Illinois coal by chemical (KOH) activation . A CMS prepared without KOH adsorbs more O_2 than N_2 and has O_2/N_2 adsorption properties similar to that of a commercial CMS used in air separation. The molecular sieve properties of these two coal based carbons are compared in figure 1. The kinetics of O_2 adsorption of both carbons is nearly identical during the first five minutes of adsorption. The main difference lies in their behavior toward the adsorption of nitrogen during the first two minutes. The commercial product adsorbs much less nitrogen than the ISGS CMS. Minimizing N_2 adsorption during the first two minutes presents a major challenge to aspiring CMS manufacturers.

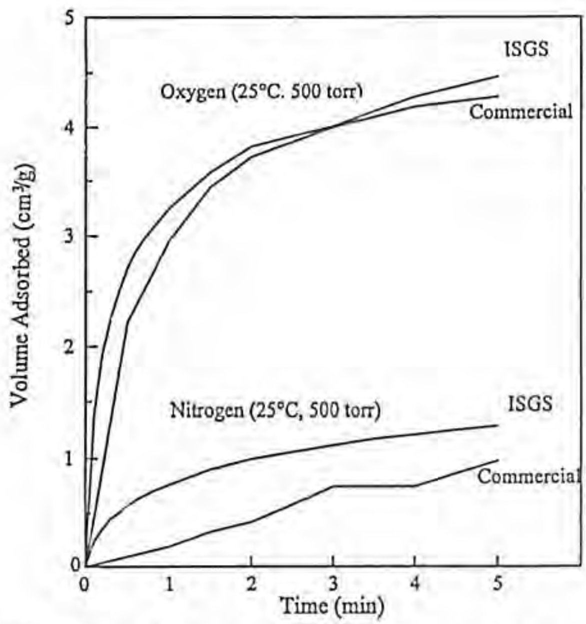

Figure 1. Adsorption of oxygen and nitrogen from air by commercial and ISGS CMS.

The carbon activated by KOH, on the other hand, adsorbed more N_2 than O_2, and had an O_2/N_2 selectivity that was essentially 1:1. The pore structure of this carbon was modified by carbon deposition (CD), using methane as the cracking gas. CD increased the O_2/N_2 selectivity, but decreased O_2 capacity. In an attempt to further improve the potential of selected carbons to separate the components of air, the activated carbons were subjected to a nitric-acid (HNO_3) oxidation treatment. This treatment is analogous in some respects to CD, but instead of carbon, oxygen is chemisorbed as carbon-oxygen complexes at the entrance to the micropores. The oxygen deposition is reversible. The initial results showed that the air separation capability of carbon that was treated with nitric acid was strongly dependent on the temperature to which it was heated before O_2/N_2 adsorption. The quality of the separation also depended on the initial micropore structure of the carbon. Several activated carbons showed good potential for efficient separation of CO_2 and CH_4, CO_2 and H_2 and CH_4 and H_2; both a high adsorption capacity and selectivity were achieved. A commercial CMS manufacturer has shown considerable interest in the ISGS CMS produced from Illinois coal.

Methane Storage

Natural gas is emerging as one of the leading alternatives to conventional automobile fuels. It offers many environmental benefits, because it burns more completely and produces fewer air pollutants than gasoline. A natural gas vehicle (NGV) uses a conventional internal combustion engine with only minor modifications. There are about 40,000 NGVs in the U.S. and about one million worldwide.[17] In the short term, depot-based commercial fleets (e.g., buses and taxis) will be the first users because of NGV's limited range and the lack of a fuel-service infrastructure. There are three technologies for onboard natural gas storage: liquefied natural gas, compressed natural gas (CNG) and adsorbed natural gas (ANG). CNG has been commercialized worldwide. ANG uses adsorbents and operates at a much lower storage pressure (500 psig) than CNG (3,000 psig). Improvements in the technologies for ANG storage will offer significant opportunities for reducing capital and operating costs of NGVs.[18-20]

The key ingredient for successful commercialization of ANG storage is the adsorbent. The ability of an adsorbent to store natural gas is usually evaluated in terms of its volumetric methane storage capacity (Vm/Vs), where Vm is the volume of stored methane at standard temperature and pressure, and Vs is the volume of the storage container. The commercial development of ANG storage will require low cost adsorbents (< $2.00/1b) with high gas-storage capacities (> 150 Vm/Vs).[19] Activated carbons have the most favorable gas-storage capacity,[18] and assuming that the estimated two million NGVs in the year 2010[21] each require 200 pounds of activated carbon for ANG storage, as much as 600,000 tons of coal would be needed to produce this amount of activated carbon.

Activated carbons for ANG storage were produced in our research by both physical and chemical activation of an Illinois coal. The storage capacities (Vm/Vs) of the resulting activated carbons toward methane were measured at pressures up to 500 psig. The properties of several physically-activated carbons and one chemically-activated carbon are presented in Table 1. The Vm/Vs values of activated carbons derived from Illinois coal ranged from 54 to 76 cm^3/cm^3. These values are comparable to that of BPL (72 cm^3/cm^3), a commercial activated carbon manufactured by Calgon Carbon Corp. Vm/Vs values exceeding 100 cm^3/cm^3 were achieved by grinding the granular products derived from Illinois coal. The increase in Vm/Vs is due to the resulting increase in bulk density. The chemically-activated (KOH) coal-derived carbon has a higher surface area, micropore volume, and methane adsorption capacity (g/g), but a lower volumetric methane storage capacity, than the physically-activated carbons. The lower volumetric methane storage capacity is due to the lower bulk density of the KOH-activated carbon. Work is in progress to produce carbon products with Vm/Vs values that approach 150.

Table 1. Methane storage properties of activated carbons prepared from Illinois coal and a commercial activated carbon, BPL.

Sample ID	Surface area (BET, m^2/g)	Micropore Vol. (cm^3/g)	CH_4 adsorption at 500 psig (g/g)	Bulk density (g/cm^3)	Vm/Vs (cm^3/cm^3)
A1	897	0.330	0.0525	0.33	54
B1	1037	0.370	0.0643	0.44	73
C1	1056	0.410	0.0610	0.44	76
D2	1478	0.620	0.0903	0.27	68
BPL	1000	0.430	0.0606	0.46	72

[1]Prepared by physical activation (steam) of Illinois coal.
[2]Prepared by chemical activation (KOH) of Illinois coal.

Flue-Gas Cleanup

Worldwide interest in carbon-based flue-gas desulfurization (FGD) technology is growing and these processes have been proven successful at removing up to 95 percent of the SO_2 and more than 80 percent of the NO_x from combustion flue gas. An activated carbon FGD process can be used alone or with other methods of FGD. This technology is being used in Europe and Japan for cleanup of flue gas from both coal combustion[22] and waste incineration[23]. Currently, no U.S. utility employs a carbon-based process to clean flue gas. Carbon-based FGD systems can be integrated into both new and existing power plants. The retrofit of an existing utility boiler with such a FGD process could, besides improving SO_2/NO_x emissions, lower overall capital and operating costs in comparison with competitive FGD processes.[24] One unique advantage of an activated carbon FGD process is that it can significantly reduce the emission of nearly every impurity found in combustion flue gas including SO_2/NO_x, particulates, mercury, dioxins, furans, heavy metals, and other trace elements. No other existing FGD process has that capability.

There are many research groups currently involved in the development of novel carbon-based processes and materials for flue-gas cleanup. The type of carbon used usually dictates the economic viability of a given process. A high-quality carbon adsorbent for combined SO_2/NO_x removal should have the following properties: high adsorption capacity, rapid adsorption kinetics, low reactivity with oxygen, minimal loss of activity after regeneration, high mechanical strength, and low cost.

Carbons with varying pore structure and surface chemistry were prepared from Illinois coal under a wide range of pyrolysis and activation conditions, and tested for their ability to remove SO_2 from simulated flue gas (2500 ppmv SO_2, 5% O_2, 10% H_2O, balance He). Fundamentals of the SO_2 carbon reaction were studied in an attempt to learn the properties of activated carbons necessary for optimal SO_2 removal.[25-27] Based on our current understanding, we have proposed a new mechanism for SO_2 removal by carbon.[26,28] A novel carbon preparation method similar to that used for producing CMS, involving nitric acid treatment followed by thermal desorption of carbon oxygen (C-O) complexes, was developed to produce an activated carbon with an SO_2 adsorption capacity comparable to the best available commercial carbon, Centaur. Figure 2 shows the weight gain due to SO_2 adsorption for the ISGS and Centaur carbons. Centaur is produced commercially by Calgon Carbon Corporation for about $2.50/lb and was designed for both liquid and gas phase adsorption processes, including SO_2/NO_x removal.

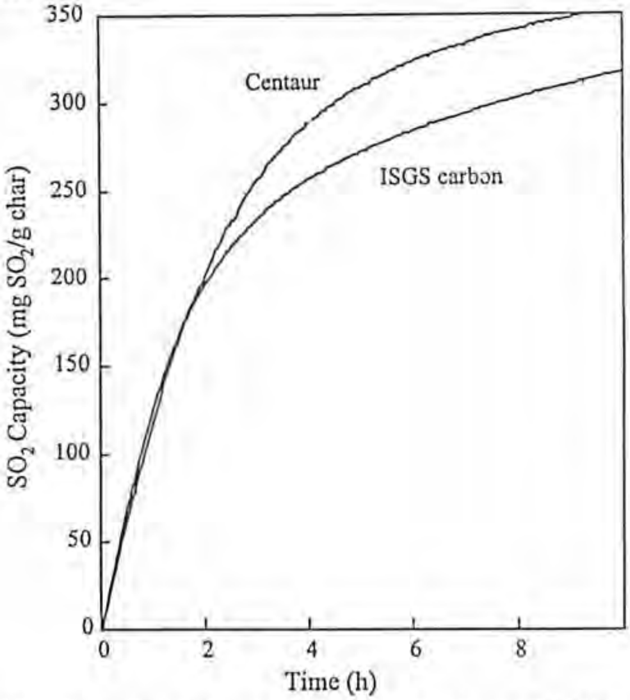

Figure 2. SO_2 adsorption behavior of Calgon Centaur and ISGS carbon prepared from Illinois coal.

The ISGS collaborated with several organizations during this study, to integrate activated carbons derived from Illinois coal into flue-gas cleanup processes that are commercialized or on the verge of commercialization. The organizations included the Research Triangle Institute, Sorbent Technologies Corporation, STEAG Aktiengesellschaft and Mitsui Mining Company Limited. The Research Triangle Institute (RTI) developed a novel carbon-based process to remove SO_2/NO_x from coal combustion flue gas. Commercialization of this process depends on the availability of efficient, low-cost carbon catalysts. Standard SO_2/NO_x removal tests designed to predict performance in the RTI-Waterloo process[29] suggested that the SO_2-removal performance of the ISGS carbon compared favorably with that of the RTI catalyst and Centaur. The NO_x removal efficiency of an ISGS carbon in the presence of ammonia, although less than that of the RTI carbon catalyst, was better than that of Centaur.[30] Further work is needed to optimize the SO_2 and NO_x removal properties of ISGS carbons in this process, particularly their ability to be regenerated by the acid wash method used in the RTI-Waterloo process.

The ISGS and Sorbent Technologies Corporation (STC) are working together to develop a carbon from Illinois coal capable of removing NO_x from exhaust gases emitted from jet engine test cells and other stationary sources. The unique aspect of this application is that the carbon-based process would not require the use of ammonia as a reducing agent. The NO_x removal properties of selected ISGS carbons and commercial carbons were evaluated by STC at temperatures between 22° and 130°C. An ISGS carbon with superior low temperature NO_x removal properties was identified. The method used to produce this carbon is being modified to improve its performance toward NO_x removal at higher temperatures and to lower production cost.

STEAG Aktiengesellschaft (Essen, Germany) has pioneered incinerator flue gas cleanup using a low surface area (270 m^2/g) activated carbon made from German brown coal.[23] STEAG is currently seeking U.S. suppliers of activated carbons to provide them with a low cost carbon for their processes soon to be installed on U.S. waste incinerators. The potential market for activated carbon in the U.S. is estimated to be 80,000 tons/year, assuming 10 percent of U.S. incinerators adopt this technology to meet needs emanating from anticipated regulation of emissions from existing incinerators. At the ISGS, laboratory conditions were identified for the production of a carbon from Illinois coal suitable for use in STEAG's /a/c/t™ process.[31] The production steps were carried through two levels of scale up, culminating in the production of 610 pounds of activated carbon in an 18 in. ID, 10 ft heated zone, externally-fired rotary tube kiln. A three-step process, which included preoxidation, pyrolysis and activation, was used to produce a carbon with a N_2 BET surface area of 110 m^2/g and a carbon tetrachloride activity of 51, the latter being almost three times that of the carbon presently used by STEAG. STEAG found that a carbon's ability to adsorb SO_2 is indicative of its performance in their process.[32] Figure 3 shows the weight gain due to SO_2 uptake by the ISGS carbon and the carbon STEAG currently uses in its process. The two carbons exhibit similar amounts of SO_2 uptake after 8.5 h. The ISGS carbon was shipped to Germany for testing on a slip stream of flue gas from a commercial incinerator. Test results indicated that ISGS activated carbon was effective in removing 99.7 percent of the dioxins and furans from the flue gas; mercury was decreased to below detection limits.

An economic analysis of the process developed by the ISGS that was used to produce 610 pounds of activated carbon for STEAG was recently completed.[5] It showed that it would cost between $325 and $400 to produce one ton of activated carbon with a plant designed and constructed to produce 80,000 tons of activated carbon per year, assuming a 20 percent rate of return on initial investment.[5,31] One commercial carbon manufacturer has expressed interest in developing a low cost carbon for flue gas treatment.

Mitsui Mining Company Limited (Tokyo, Japan) has modified the Bergbau-Forschung (BF) process to achieve both SO_2 and NO_x removal in a single process.[22] Mitsui's process achieves 100 percent removal of SO_2 and more than 80 percent removal of NO_x from utility flue gas with activated coke. Mitsui Mining also produces 5,000 tons of activated coke per year for use in its process installed on a 350 MW fluidized-bed combustion power plant in Japan. The cost to produce the activated coke is \$800-\$1,000/ton. Mitsui has licensed its technology to General Electric and both are working together to develop new markets in the U.S. for a process that treats flue gas from coal-fired utilities. A one-kilogram sample of low-cost ISGS carbon was given to Mitsui Mining for SO_2/NO_x removal tests to be done in Japan. Mitsui Mining did a series of tests on the material and compared its performance with that of the activated coke presently used in its system. The SO_2/NO_x removal efficiencies achieved by ISGS carbon were less than that of the Mitsui coke. However, since the ISGS carbon was not specifically designed for the Mitsui Mining process, there is room for significant improvement in its SO_2/NO_x removal performance. The ISGS will continue to work with Mitsui Mining to develop a low cost activated carbon from Illinois coal suitable for use in Mitsui's combined SO_2/NO_x removal process.

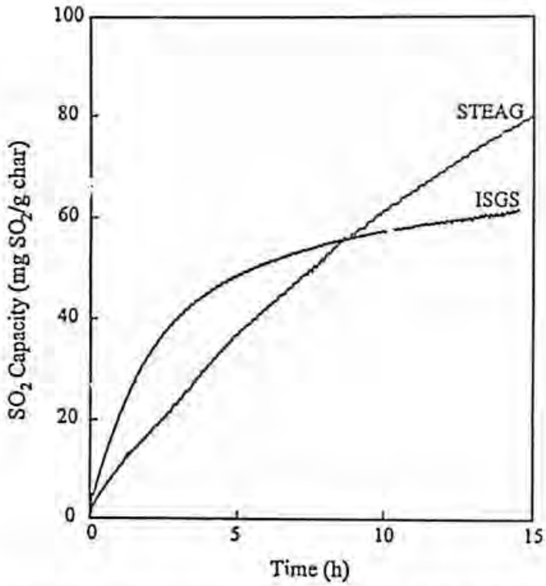

Figure 3. SO_2 adsorption behavior of ISGS carbon and carbon currently used in STEAG's process.

Mercury Removal

The Clean Air Act Amendment of 1990 lists 189 substances as hazardous air pollutants, of which 37 substances have been detected in power plants. Of these 37 hazardous air pollutants, 11 are trace metal species that are found in elemental or various oxidized forms in either the solid, aerosol, or vapor state. Mercury present in coal is of highest concern because it is not captured effectively by existing particulate removal systems and because of perceived environmental risk.

Although a number of municipal and hazardous waste incinerators have incorporated specific processes for mercury control, no such measure has been taken for coal-fired utilities. Existing data from the incinerators provide some insight on mercury control, but these data cannot be used directly for coal-fired utilities because process conditions differ greatly. For example the concentrations of mercury in flue gases from municipal solid waste (MSW) incinerators are one to two orders of magnitude higher than for coal combustion sources (typically 5 to 10 $\mu g/m^3$). Most of the mercury in MSW flue gas is in the form of $HgCl_2$; coal flue gas contains ionic and elemental mercury. Therefore, the reaction-controlling processes and the sorbent properties for effective control of mercury presumably are different for the two applications.

Pilot-scale tests with flue gas from a coal-fired plant have shown effective mercury capture by duct injection of powdered activated carbon.[33,34] Low concentrations of mercury in the flue gas along with limited exposure time of the sorbent (3 seconds) resulted in inefficient utilization of the commercial activated carbons in these sorbent injection tests. To achieve high mercury removal (>90%), the required ratio (on a weight basis) of carbon-to-mercury (C/Hg) in the flue gas was 3,000 to 10,000 depending on process conditions. Results from tests in MSW incinerators have shown that the carbon-to-mercury ratio is more than an order of magnitude lower than that necessary for a similar degree of mercury removal in coal combustors.

The ISGS is currently developing activated carbons tailored for mercury removal from utility flue gas. This work is partially funded by EPRI.[4] Recent results showed that film mass transfer plays a dominant role in the removal of Hg from utility flue gas by activated carbon injection.[30] Theoretical C/Hg ratios were calculated for typical conditions assuming a process controlled by mass transfer. The results were consistent with C/Hg ratios found necessary for Hg removal in pilot scale tests.[35] According to the mass-transfer calculations, a reduction in the sorbent particle size increased both the mass-transfer coefficient and the gas-solid interfacial area. Therefore, it appears that the most effective way to reduce the C/Hg ratio for the powder injection method is to reduce the carbon particle size.

In a mass-transfer-limited process the internal structure of carbon may not be important. Commercially available activated carbon sorbents for mercury removal tend to be expensive ($1,000 to $2,000/ton). Alternative sorbents such as a low cost, lower surface area, or higher reactivity activated carbon could improve the economic feasibility of a carbon-injection process.

CONCLUSIONS

The ISGS has developed expertise and capabilities for producing from Illinois coal activated carbons that are tailored for specific applications, including gas separation, methane storage and flue gas cleanup. Efforts are underway to integrate these Illinois coal-based, high-value products into existing commercial processes, or those on the verge of commercialization. Table 2 shows estimates of the potential markets that can be envisioned for use of these high-value products. The amount of coal that might be needed for high-value products varies from two to four times the weight of the high-value products marketed. The estimated usage of coal, as well as the estimated current price of activated carbons used in the various applications, are included in Table 2. These estimates suggest a significant potential for using Illinois coal in the production of high-value, carbon-based products. The production of high-value, carbon-based materials will continue to be a focus of research efforts of scientists and engineers at the ISGS.

Table 2. Estimate of coal and activated carbon usage in various applications (by the year 2010).

Application	Coal (tons)	Activated carbon (tons)	Price ($/tons)	Value (Mill. $)
CMS	30,000	10,000	10,000	100
STEAG	160,000	80,000	400	32
NGV	300,000	100,000	4,000	400
Hg removal	250,000	100,000	500	50
Total	740,000	290,000	—	582

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REFERENCES

1. Lizzio, A.A. and Rostam-Abadi, M., "Production of Carbon Molecular Sieves from Illinois Coal," Fuel Processing Technology, v. 34, p. 97-122, 1993.

2. Sun, J., Rood, M. J., Rostam-Abadi, M., Lizzio, A. A., "Natural Gas Storage with Activated Carbon from a Bituminous Coal," special issue of Gas Separation and Purification, *in press*.
3. Lizzio, A. A., DeBarr, J. A., Donnals, G. L., Kruse, C. W., Rood, M. J., Gangwal, S. K., "Production and Use of Activated Char for Combined SO_2/NO_x Removal," Final Technical Report to Illinois Clean Coal Institute, Carterville, Illinois, 1995.
4. Rostam-Abadi, M., Chen, S. and Chang, R., "Preparation and Evaluation of Novel Activated Carbons from Illinois Coal for Mercury Removal," Quarterly Technical Report to Illinois Clean Coal Institute, Carterville, Illinois, 1995.
5. Kruse, C. W., Lizzio, A. A., Rostam-Abadi, M., DeBarr, J. A., Bhagwat, S. B. and Lytle, J. M., "Producing Activated Carbon for Cleaning Flue Gas from Incinerators," Final Technical Report to Illinois Clean Coal Institute, Subgrant 22CRGTSK592C, 1995.
6. Patrick, J. W., ed., "Porosity in Carbons: Characterization and Applications," Halsted Press, Great Britain, p. 1-48, 1995.
7. Armor, J. N., "Carbon Molecular Sieves for Air Separation," *in* Proceedings of 20th Biennial Conference on Carbon, Santa Barbara, CA, p. 40-41, 1991.
8. Schröter, H. J., "Carbon Molecular Sieves for Gas Separation Processes," Plenary Lecture, AIChE Summer National Meeting, Seattle, WA, 1993.
9. Kapoor, A. and Yang, R. T., "Kinetic Separation of Methane-Carbon Dioxide Mixture by Adsorption on Molecular Sieve Carbon," Chemical Engineering & Science, v. 44, p. 1723-1733, 1989.
10. Vyas, S. N., Patwardhan, S. R. and Gangadhar, B., "Carbon Molecular Sieves from Bituminous Coal by Controlled Coke Deposition," Carbon, v. 30, p. 605-612, 1992.
11. Verma, S. K. and Walker, P. L., Jr., "Alteration of Molecular Sieving Properties of Microporous Carbons by Heat Treatment and Carbon Gasification," Carbon, v. 28, p. 175-184, 1990.
12. Jüntgen, H., Knoblauch, K. and Harder, K., "Carbon Molecular Sieves: Production from Coal and Application in Gas Separation," Fuel, v. 60, p. 817-822, 1981.
13. Schröter, H. J., "Carbon Molecular Sieves for Gas Separation Processes," Gas Separation and Purification, v. 7, p. 247-251, 1993.
14. Nandi, S. P. and Walker, P. L., Jr., "Separation of Oxygen and Nitrogen Using 5A Zeolite and Carbon Molecular Sieves," Separation Science II, v. 5, p. 441-453, 1976.
15. Toda, Y., Yuki, N. and Toyoda, S., "Change in Pore Structure of Active Carbon with Heat Treatment," Carbon, v. 10, p. 13-18, 1972.
16. Patel, R. L., Nandi, S. P. and Walker, P. L., Jr., "Molecular Sieve Characteristics of Slightly Activated Anthracite," Fuel, v. 51, p. 47-51, 1972.

17. Alson, J. A. Adler, J. M. and Baines, T. M., *in* Alternative Transportation Fuels, Quorum Books, New York, 1989.
18. Golovoy, A., *in* Proceedings Compressed Natural Gas Soc. Auto. Eng., Pittsburgh, PA, 1983.
19. Nelson, C. R., "Physical Sciences NGV Gas Storage Research," Gas Research Institute, Chicago, IL, 1993.
20. Wegrzyn, J. Weismann, H. and Lee, T., Proceedings Annual Automotive Tech. Develop., Dearborn, MI, 1992.
21. Ban, S. D., "New Products, Collaborative R&D Boost NGV Potential," Natural Gas Fuels, Gas Research Institute, April, 1993.
22. Tsuji, K. and Shiraishi, I., "Mitsui-BF Dry Desulfurization and Denitrification Process Using Activated Coke," *in* Proceedings of the EPRI SO_2 Control Symposium, Washington, D.C., p. 307-324, 1991.
23. Brueggendick, H. and Pohl, F. G., "Operating Experience with STEAG's Activated Carbon Process-a/c/t™ in European Waste Incineration Plants," *in* Proceedings of 10th Annual International Pittsburgh Coal Conference, Pittsburgh, PA, p. 787-794, 1993.
24. Richter, E., Knoblauch, K. and Jüntgen, H., "Methods Using Activated Coke for Removal of SO_2 and NO_x from the Flue Gases of Firing Systems," *in* Proceedings of First International Conference on Processing and Utilization of High Sulfur Coals, p. 563-574, 1985.
25. DeBarr, J. A., Lizzio, A. A. and Daley, M. A., "Adsorption of SO_2 on Bituminous Coal Char and Activated Carbon Fiber Prepared from Phenol Formaldehyde," American Chemical Society Preprints, Fuel Chemistry Division, v. 41(1), p. 339-343, 1996.
26. Lizzio, A. A., and DeBarr, J. A., "The Mechanism of SO_2 Removal by Carbon," American Chemical Society Preprints, Fuel Chemistry Division, v. 41(1), p. 201-205, 1996.
27. DeBarr, J. A., "The Role of Free Sites in the Removal of SO_2 from Simulated Flue Gases by Activated Char," M.S. Thesis in Environmental Science, University of Illinois at Urbana-Champaign, 1995.
28. DeBarr, J. A. and Lizzio, A. A., "New Insights in the Mechanism of SO_2 Removal by Carbon," *in* Proceedings of 22nd Biennial Conference on Carbon, San Diego, CA, p. 562-564, 1995.
29. Gangwal, S. K., Howe, G. B., Spivey, J. J., Silveston, P. L., Hudgins, R. R. and Metzinger, J. G., "A Novel Carbon-based Process for Flue Gas Cleanup," Environmental Progress, v. 12, p. 128-136, 1993.
30. Lizzio, A. A, DeBarr, J. A., Donnals, G. L., Kruse, C. W., Rood, M. J. and Gangwal, S. K., "Production and Use of Activated Char for Combined SO_2/NO_x Removal," Final Technical Report to Illinois Clean Coal Institute, Carterville, IL, 1995.
31. Lizzio, A. A., DeBarr, J. A. and Kruse, C. W., "Development of Low Surface Area Char for Cleanup of Incinerator Flue Gas," *in* Proceedings of 22nd Biennial Conference on Carbon, San Diego, CA, p. 744-746, 1995.

32. Rummenhol, V., Presentation to Illinois Coal Development Board, Illinois Clean Coal Institute and Illinois State Geological Survey, Champaign, IL, March 2, 1994.
33. Chang, R. and Owens, D., "Developing Mercury Removal Methods for Power Plants," EPRI Journal, July/August, p. 46-49, 1994.
34. Felsvang, K., Gleiser, R., Juip, G. and Nielsen, K. K., "Activated Carbon Injection in Spray Dryer/ESP/FF for Mercury and Toxics Control," Fuel Processing Technology, v. 39, p. 417-430, 1994.
35. Chen, S., Rostam-Abadi, M. and Chang, R., "Mercury Removal from Combustion Flue Gas by Activated Carbon Injection: Mass Transfer Effects," American Chemical Society Preprints, Fuel Chemistry Division, v. 41(1), p. 442-447 , 1996.

Robert Kudlawiec: I would like to take this opportunity to thank our four speakers for their excellent presentations. I would like to acknowledge this fine effort by way of applause [Applause]. If there are no other questions, I would like to adjourn this meeting. Thank you all for coming.

[The 103rd Annual Meeting of the Illinois Mining Institute was adjourned at approximately 1:00 p.m., Friday, September 29, 1995. Immediately following the adjournment, President David Webb drew two raffle tickets in the lobby of the Gateway Center. Winner of the two airline tickets to anywhere in the continental United States was Mr. James Scott of Scott M.T.S., Rolla, Missouri. Winner of the set of jumbo golf clubs was Mr. John C. Larson, Michigan Industrial Lumber Company, Whiting, Indiana.]

Dave Webb draws the winning raffle tickets at the close fo the 103rd Annual Meeting.

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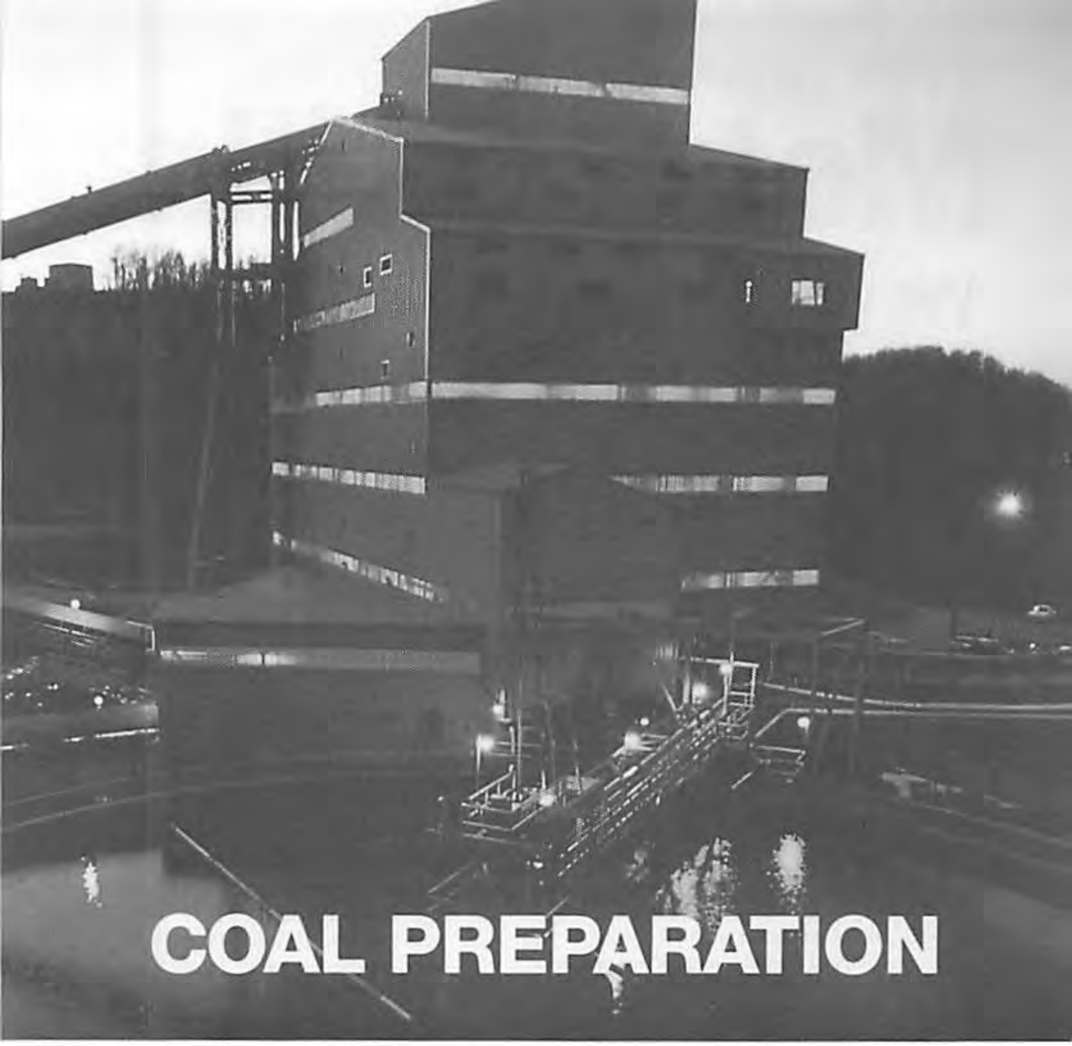
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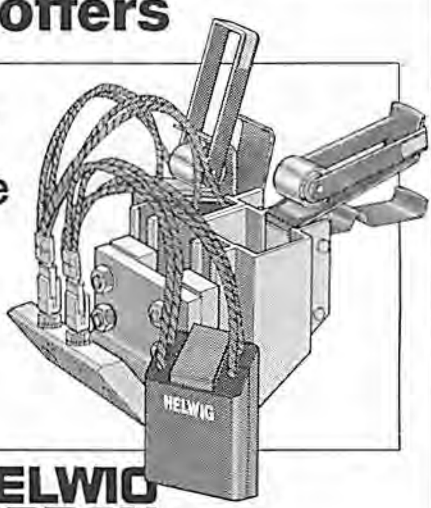
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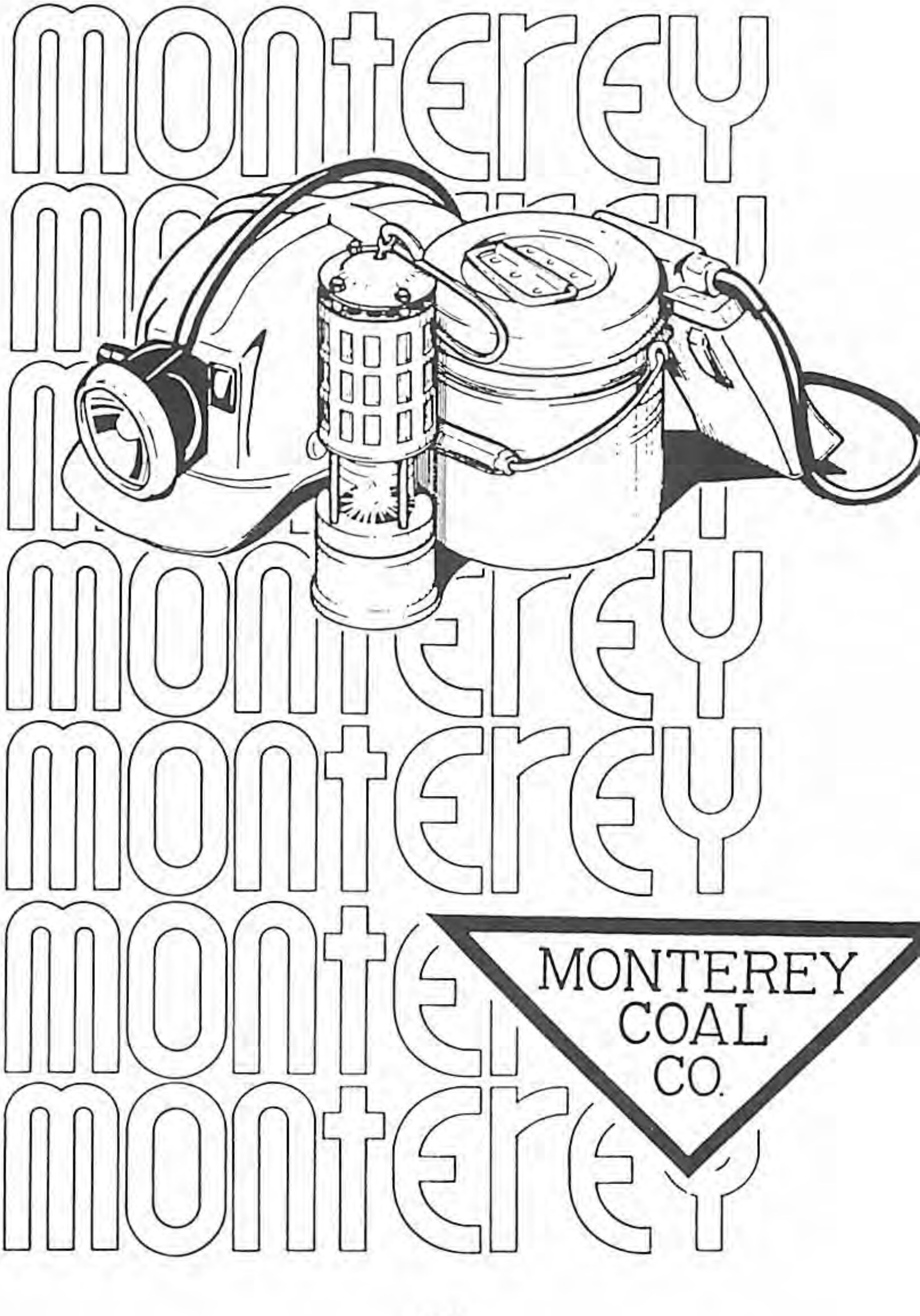
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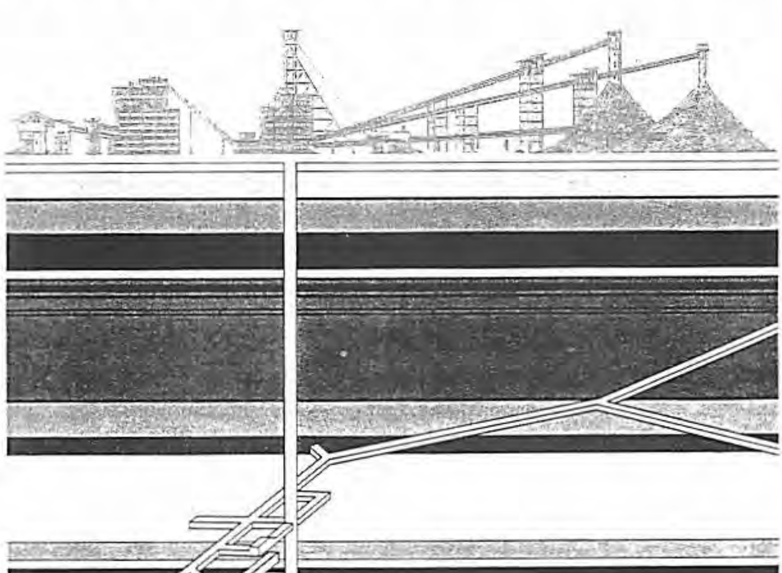

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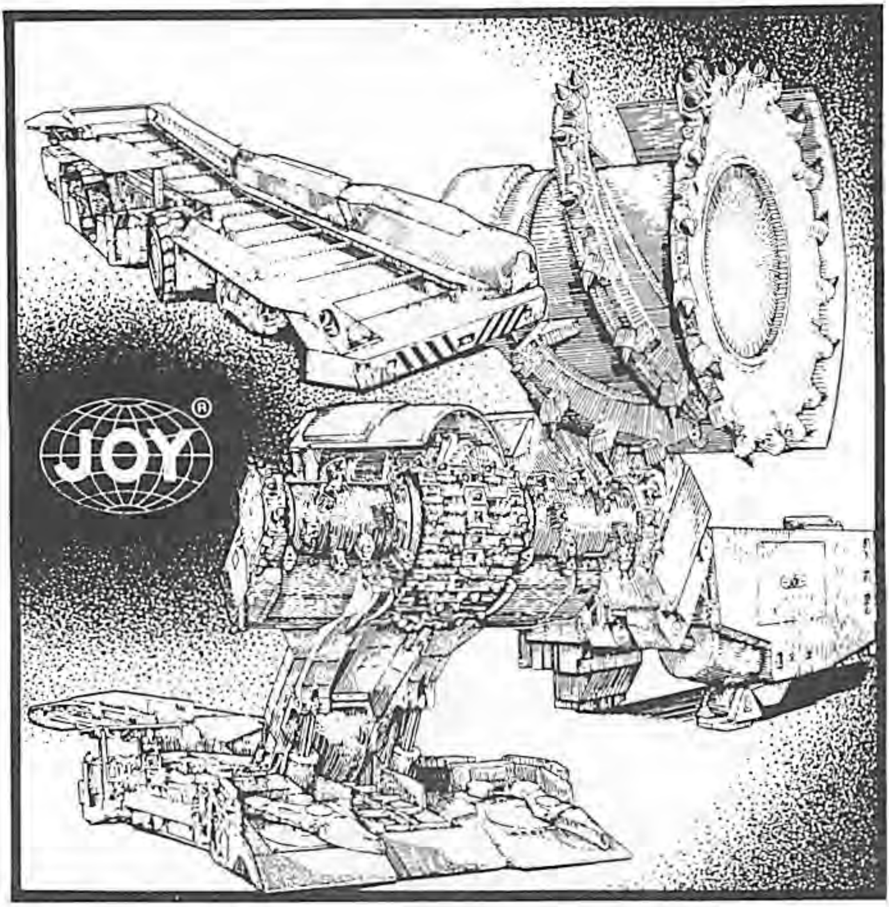
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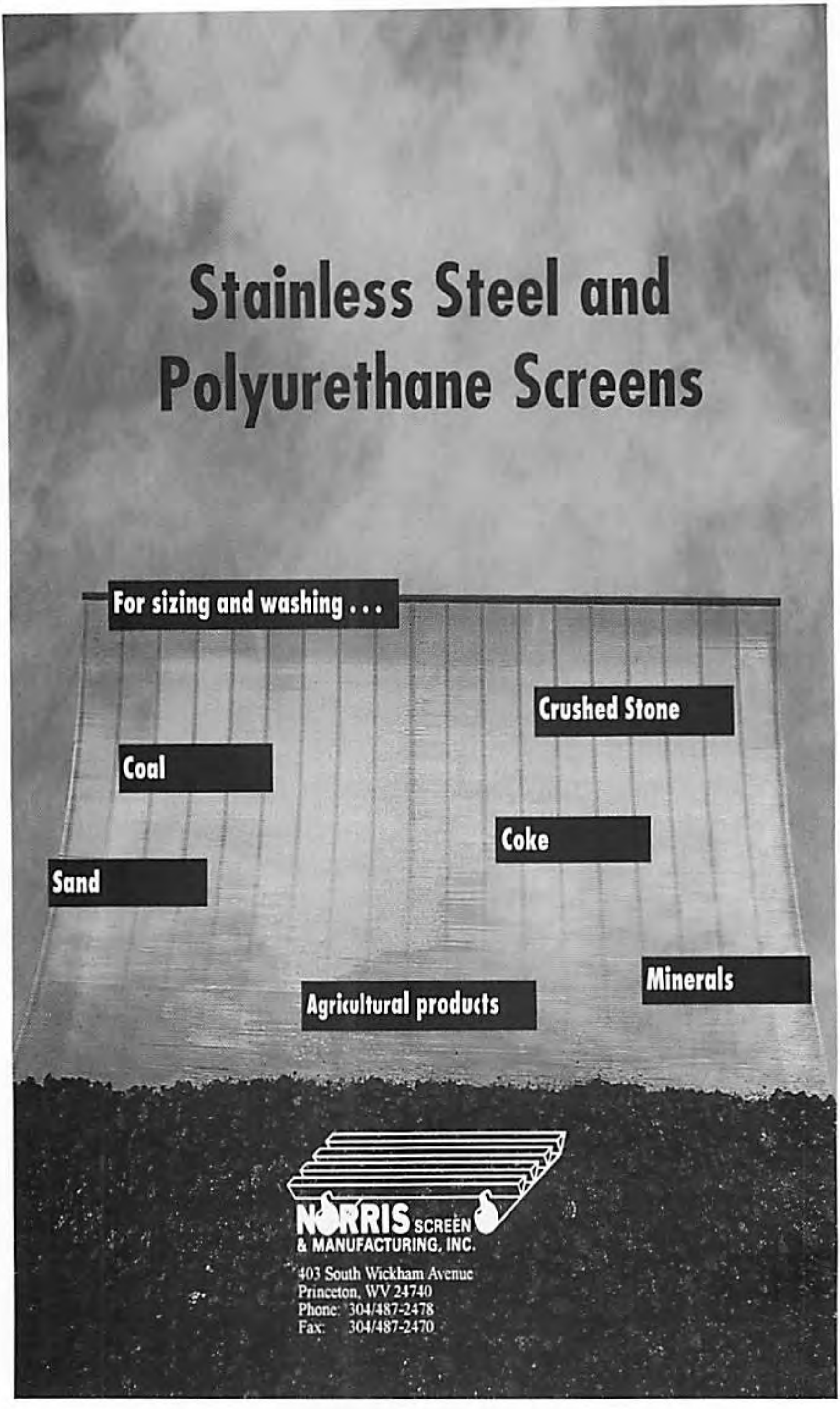

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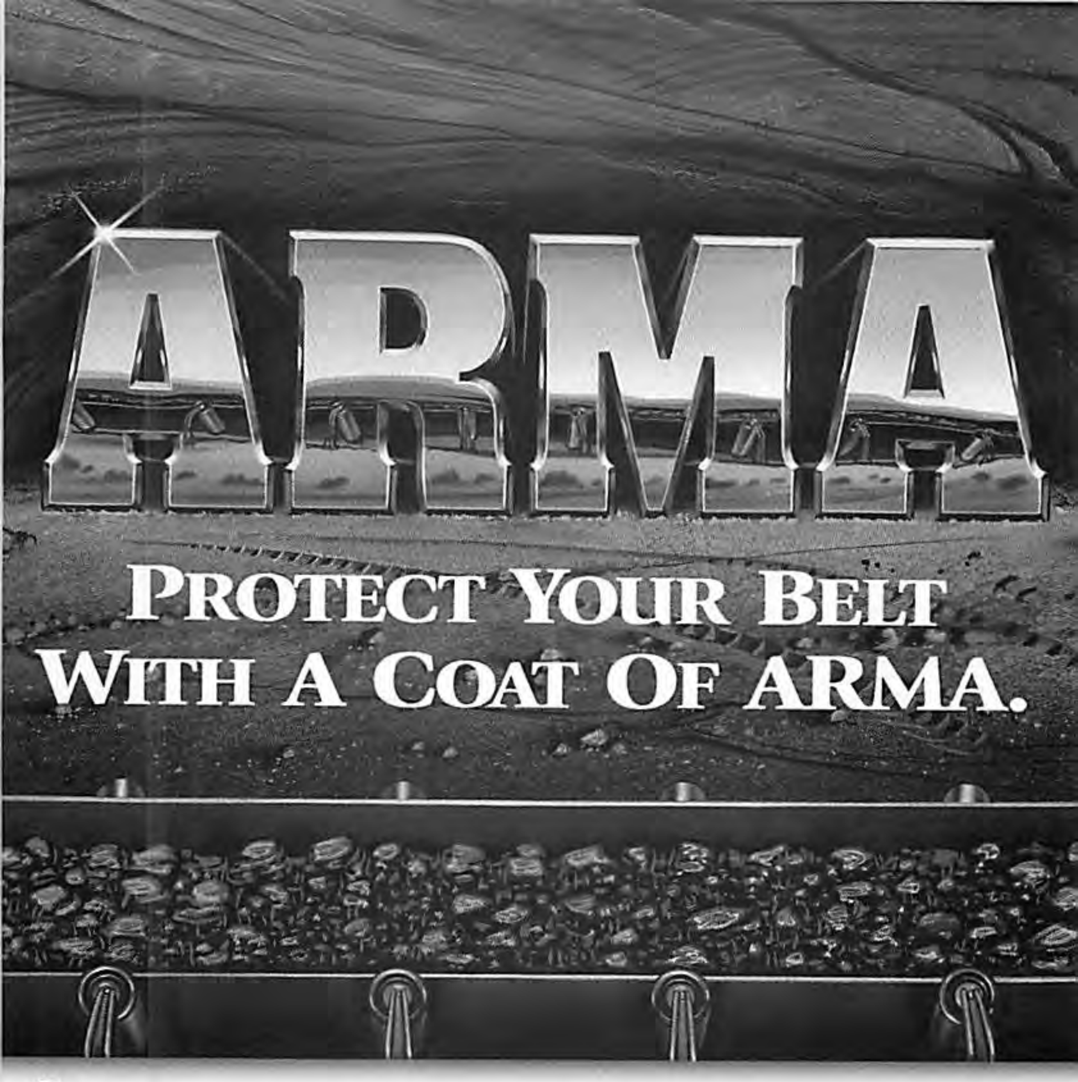
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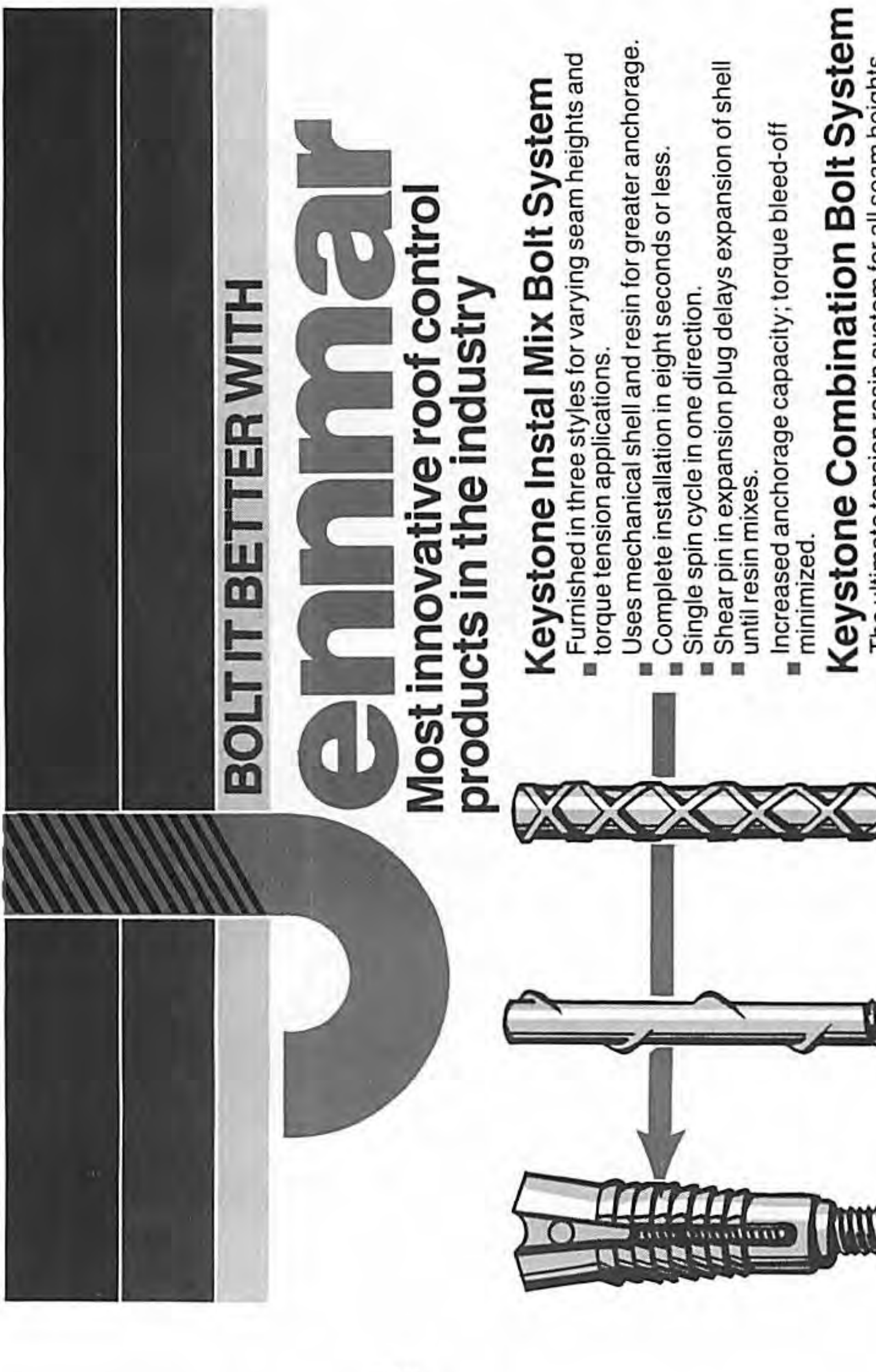
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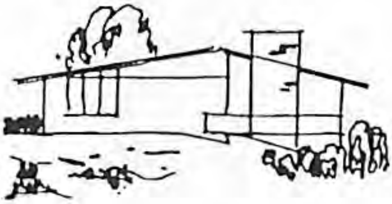

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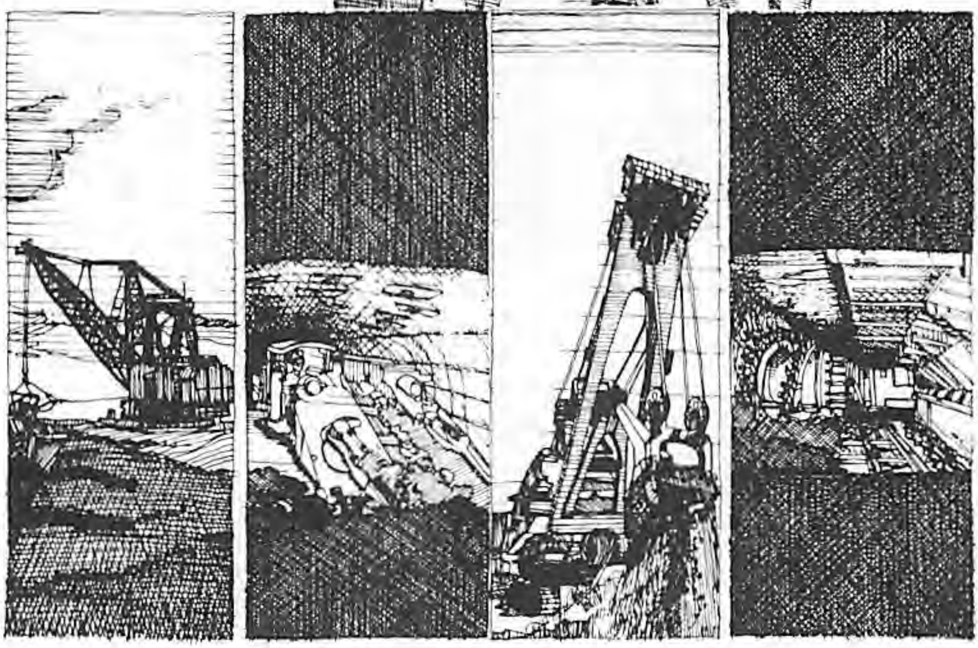

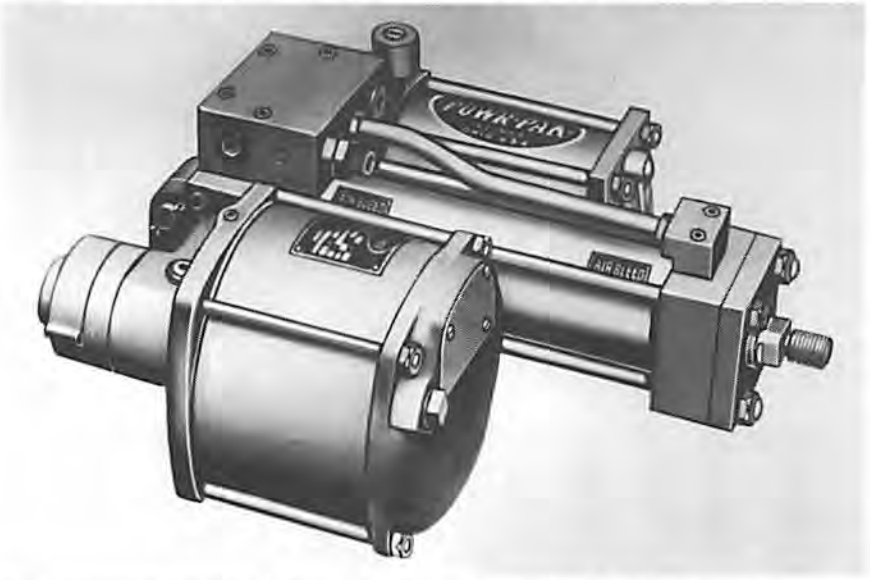
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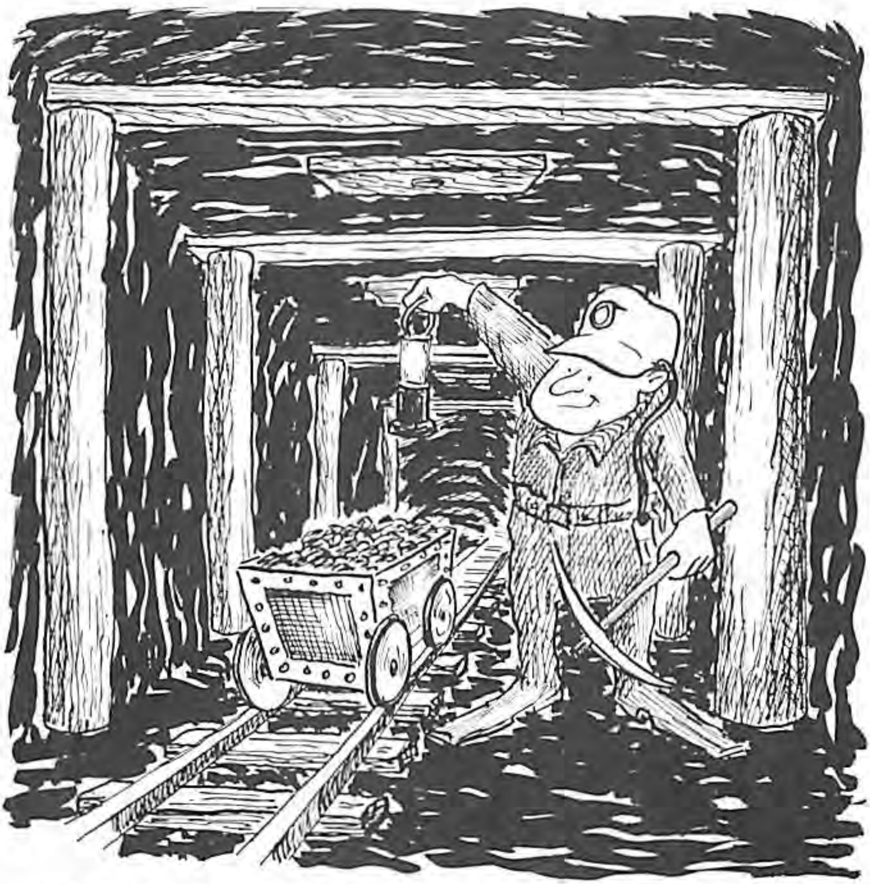

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